SCIENTIFIC AMERICAN

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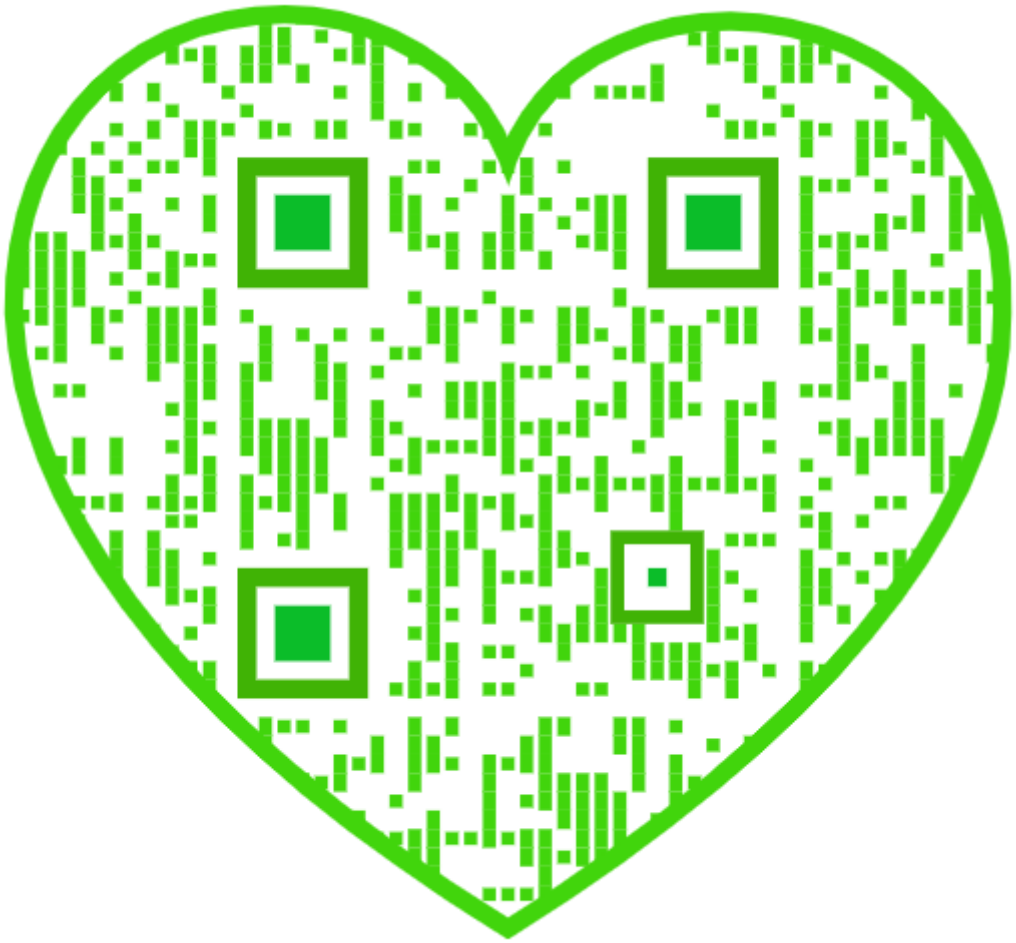
Vol. XCVIII.—No. 22. ESTABLISHED 1845. NEW YORK, MAY 30, 1908. 10 CENTS A COPY $3.00 A YEAR.

This Aeroplane is the First Dynamic Flying Machine to Traverse a Considerable Distance and Carry Two Men at a Speed of 45 Miles an Hour. A Similar Aeroplane to be Built for the United States Government by the Last of August Must Remain in the Air for an Hour and Cover 40 Miles in That Time.

THE WRIGHT 30-HORSE-POWER AEROPLANE IN FLIGHT ABOVE THE NORTH CAROLINA COAST.—DRAWING PREPARED FROM DESCRIPTIONS BY OBSERVERS OF THE EXPERIMENTS.—[See page 898.]



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) ..... $3.00 a year
Scientific American Supplement (established 1876) ..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MAY 30, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

GRATIFYING DECREASE IN RAILWAY ACCIDENTS.

It has for so many years been our painful duty to record and deplore the steady growth in the number of accidents on our railroads, that we find great satisfaction in the latest Accident Bulletin of the Interstate Commerce Commission dealing with the last three months of 1907. The statistics show that there is a marked decrease, both in the number of train accidents, and the number of passengers killed or injured. There is a decrease as compared with the previous quarter and with the corresponding quarter in 1906. Out of a total number of 220 persons killed, only 21 were passengers, as against 110 passengers killed in the preceding quarter and 180 killed during the corresponding quarter of the previous year. These results prove that there has been a remarkable improvement in the safety of operating, the chief cause of which is not far to seek. A correspondent has recently asked us whether the greater danger of travel on American roads is not largely due to the frequent congestion of freight traffic, and its consequent derangement of train schedules. We believe that it is. Furthermore, the sudden reduction in accidents occurred simultaneously with the development of the recent panic and the extraordinary falling off which occurred in the freight business of the country. With between three and four hundred thousand cars laid aside, it has become possible for the rest of the freight traffic to be moved on schedule time and with those intervals of spacing which are so conducive to safety of operation. Moreover, the breaking up of the congestion has necessitated the laying off of thousands of employees, and those selected for discharge were, naturally, the inexperienced or incompetent men, taken on in the rush seasons, to whom a large number of the accidents must necessarily have been due. Lastly there can be no doubt that the gradual expansion of the block signal system, and the growing appreciation of the necessity for strict obedience to its mandates, are becoming potent factors in rendering railroad travel reasonably secure.

MR. HILL ON OUR NATURAL RESOURCES.

Particular value attaches to any statement by Mr. J. J. Hill on the subject of the natural resources of this country; for there are probably few, if any, men who have given the subject such deep study, or considered it from so broad and statesmanlike a point of view. As one of the principal speakers of the recent conference at the White House, after drawing attention to the fact that the sum of natural resources of a country is simple and fixed, he asks: How stands the inventory of property for our own people? And he answers his own question categorically, as regards the wealth that may be taken from the sea, the mine, the forest, and the soil to sustain the life of man. The resources of the sea furnish less than five per cent of the food supply of the United States. As to the forests of the country, the most reliable estimates reckon our standing merchantable timber at less than 2,000 billion feet, yet we are cutting annually about 40 billion feet, and the amount of lumber cut rose from 18 billion feet in 1880 to 34 billion in 1905. Compared with other countries, we are using annually 500 feet of timber per capita as against an average of 60 feet for all Europe. The New England supply is gone; the Northwest furnishes only small growths; the Southern production is declining; and on the Pacific coast alone is there any considerable body of standing merchantable timber. We consume yearly three or four times as much timber as is restored by the annual forest growth. Some varieties will be gone in ten years' time, and unless reforesting is resorted to, other timbers will be exhausted during the present century. So also in the iron industry, the amount of iron ore mined in the United States doubles once in seven years. The figures as here given by Mr. Hill are truly startling. In 1893 less than 12,000,000 tons were mined. This had risen to 24,000,000 tons in 1899; 47,740,000 tons in 1906, and over 52,000,000 tons in 1907. Our stores of coal are similarly threatened with early exhaustion. As to the only remaining resource, the soil itself, we are told that there are but 50,000,000 acres of surveyed, and 36,500,000 acres of unsurveyed land remaining unappropriated, and 21,000,000 acres were disposed of in 1907. Fortunately, there are two well-established remedies for the already greatly exhausted soil, namely, rotation of the crops and the use of fertilizers. In the presence of these statistics, Mr. Hill may well say that the era of unlimited expansion on every side, of having but to reach out and seize any desired resources, provided for us by the hand that made the foundations of the earth, is drawing to a close.

LOWERING THE TRANSATLANTIC RECORD.

Now that the heavy storms of the winter are over, and the Atlantic is settling down to its comparative summer quiet, the two big turbine liners are beginning to reduce the time of the transatlantic passage with remarkable regularity. On her last westward passage to this port the "Lusitania" broke three ocean records, having made the highest average speed of the whole run, the longest single day's run, and the shortest time over the long summer course from Daunt's Rock to the Sandy Hook lightship. The winter course across the Atlantic is 2,781 knots and the summer course measures 2,889 knots. Toward the close of last year the "Lusitania" covered the short course in 4 days 18 hours and 40 minutes, and the "Lusitania" in her recent run over the long course took only 1 hour and 42 minutes longer time than that, her total for the passage being 4 days 20 hours and 22 minutes. Her average speed was 24.83 knots for the entire voyage. The record run for a single day was made from noon on Tuesday until noon on Wednesday, when she covered 632 knots. The steadiness of her running is shown by the successive days' steaming, the total distances run on each entire day being 622, 625, 632, and 628 knots. On the day that she made the record run, the "Lusitania" maintained an average speed of 25.42 knots, which is equivalent to over 29 land miles per hour. Had she traveled over the short course at the speed which she maintained during this trip, she would have covered the distance in 4 days and 16 hours, which would have been 2 hours and 40 minutes better than any previous record.

OUR RANK AS SECOND NAVAL POWER.

When the leading naval annual in Great Britain in estimating the relative strength of the world's navies recently placed the United States in the second position, on the ground that she could put in the battle line more heavy, armor-piercing guns than any navy except that of Great Britain, the estimate was widely accepted both in this country and abroad. Our nearest competitor for second place is Germany, and this in spite of the fact that in her earlier ships that are still reckoned as effective, she mounted the 9.4-inch gun as the main armament. It is the present activity of Germany in the construction of exceptionally powerful battleships of the all-big-gun type, coupled with her ambitious and systematic programme for the future, which renders it certain that if any navy displaces us from second position in the next three years it will be that of our German friends.

As matters now stand the United States possesses twenty-five battleships of a total displacement of 334,146 tons; Germany twenty-three of 276,166 tons. Of armored cruisers the United States has fifteen of 186,545 tons, and Germany ten of 113,528 tons. The total tonnage of American armored ships now afloat is 520,691 tons, and Germany possesses 389,694 tons of armored ships. Of the 25 United States battleships none mounts a gun in the main battery of less than 12 inches caliber. Among the twenty-three German battleships ten carry nothing heavier than a 9.4-inch rifle.

As we have often pointed out in these pages, the fighting strength of the navy lies in its battle line, and since the Japanese war it has come to be well understood that the strength of the battle line lies in the number of heavy armor-piercing guns that can be concentrated in a given length of that line. Although the United States at present holds a decided lead over its nearest rival, the question of future preponderance, unless we maintain our recently-announced policy of building two battleships a year, seems to lie with the German navy, because of the systematic plan of new construction covering a series of years which that country has adopted. By an act passed in 1900 and amended in 1906 the German navy in the year 1917 will contain thirty-eight battleships, all the newer ships to be of the "Dreadnought" type. Three of these are to be built this year; three in 1909, and three in 1910. Two will be built in 1911, and then one a year up to the year 1917. Three of these "Dreadnoughts" are now under construction, and one of them, the "Nassau," was recently launched. They are of 19,000 tons displacement, and are variously credited with carrying an armament of from twelve to sixteen 11-inch, 50-caliber guns of great power. Two other battleships of the mixed-caliber type, carrying each four 11-inch guns, are also under construction.

Now had the question of future increase of our navy been left to be determined by the haphazard method of previous years, there might well have been some concern for our holding the position of second naval power. Fortunately, the United States Senate, in authorizing the construction of two more 20,000-ton "Dreadnoughts," adopted for the future a definite naval policy of authorizing two battleships a year. If the United States maintains this programme, we shall have by the year 1917 forty-nine battleships, supposing, of course, which is not likely, that some of our earlier battleships will not have been struck off the list as non-effective. The German navy, unless some older ships be struck from the list, will in 1917 possess thirty-eight battleships. At the present time we have under construction four battleships of the "Dreadnought" type, namely, the "Michigan" and "South Carolina," of 16,000 tons, carrying eight 12-inch guns, and the "Delaware" and "North Dakota," of 20,000 tons, carrying ten 12-inch guns. Congress has also recently authorized two additional "Dreadnoughts" similar to the "North Dakota." It was a wise step on the part of the Senate to accompany the authorization of these last two ships by an appropriation for their construction, since this will enable them to be put in hand at once, and will raise the number of the "Dreadnought" type under construction at the present time to six. In this connection it is gratifying to note that one of the new ships will be built by the government at the Brooklyn navy yard, a policy which the SCIENTIFIC AMERICAN has earnestly advocated, on the ground that it will give us a most excellent ship, and will serve to maintain this our leading yard in a constant state of high efficiency.

SEVERE FIRE TESTS FOR SKYSCRAPERS.

There have been several fires in "skyscrapers" within the last few years, but few of them have afforded such a thorough test of modern fireproof construction as that which occurred recently on the eighteenth floor of the Tribune Building in Chicago. It was one of the highest fires, worthy of the name, that has ever occurred in any building. That it was an exceedingly hot one is shown by the fact that it entirely destroyed the asbestos covering of a pipe. The Tribune Building is eighteen stories high, with storage rooms on the Dearborn Street side of the top floor. The fire started, from some unknown cause, in one of these rooms, just under the roof. It had gained great headway before an alarm was turned in. The glass skylight, with reinforcing wire, melted in spots, and in others became so soft that it dropped down in fantastic shapes.

The significant feature of the fire, from the viewpoint of the constructor, was that it was confined to three small storage rooms. The firemen reported that it would probably have been confined to one, had it not been for small windows in the partitions of hollow terra cotta blocks. These partitions were not damaged by the fire, though there was nothing left, afterward, of the asbestos composition covering a six-inch water pipe that ran through the room. The pipe itself was heated to a cherry red, indicating the intensity of the fire. When the fire reached a hollow tile partition without a window, it could go no further. The terra cotta prevented any damage to the steel, and the partitions were intact after it was all over. The floor beams of the same material were found to be uninjured, though the wooden finish flooring was burned entirely through at several places. In an adjoining room were stored the records of the auditing department and the files of the Tribune for the sixty-seven years that have passed since the paper was established. Though the fire raged for some time on the other side of a partition from them, the records and files were not damaged.

A series of researches has been made by Prof. Theodore W. Richards, in conjunction with Messrs. W. N. Stull, F. W. Brink, and F. Bonnet, on the compressibility of a large number of the elements. A very ingenious apparatus was devised for making the measurements, and the results obtained show that the compressibility of an element is a periodic function of the atomic weight, and probably associated with the same causes which determine atomic volume and volatility.

THE HEAVENS IN JUNE.

BY HENRY NORR. RUSSELL, PH.D.

The faint object near Jupiter, discovered last winter at Greenwich, has turned out, as was anticipated, to be a new satellite. It has as yet been followed over so small a part of its orbit, that the exact form of the latter cannot be determined from the existing observations; but its general characteristics can be found, and these are sufficiently remarkable.

The satellite is much more distant from Jupiter than any previously known, apparently about 22 million miles, and its period of revolution is correspondingly long—about three years and eight months. Mr. Crommelin, the English astronomer, who has calculated the orbit, calls attention to the fact that it is merely tentative, being based on the assumption that the orbit is a circle. It may actually be decidedly elliptical; but this, while it may change the figures for the mean distance and period, will still leave the satellite much farther from its primary than any other in the solar system. There is still more confidence to be placed in the other facts which appear from the tentative orbit.

Its plane is considerably inclined to that of Jupiter's orbit, about 30 deg., and, most interesting of all, it goes around backward, like the outer satellite of Saturn, Phœbe, but unlike all the other satellites of Jupiter, even the recently discovered sixth and seventh (which, however, are only one-third as far from the planet as it is).

It is a very faint object, of about the sixteenth magnitude, corresponding to a diameter of perhaps thirty miles. As seen from Jupiter, it would be of the ninth magnitude—wholly invisible to the unaided human eye, and not as bright as a number of the asteroids look to us.

No previously known satellite has a period anything like as long in proportion to that of its primary.

During one revolution of Jupiter about the sun, the new satellite makes between three and four revolutions about him, as against thirteen for our moon, which comes next from this standpoint. The calculation of its orbit will therefore be very complicated, for the perturbations, due to the sun's attraction, will be very large.

To add to the complications, it will usually be impossible to see the planet and satellite in the same field, for the latter may be as much as three degrees away from the former. The photographs which show the satellite will usually not include Jupiter at all. But it will be easy enough to find the position of the satellite, compared with nearby stars, from the photograph, and then to compare these with Jupiter in some other way.

THE HEAVENS.

Our map shows the evening skies as they appear at the hour stated on its margin. Almost overhead is Boötes the Herdsman, with the splendid red star Arcturus, which fully equals any other that is now in sight. The rest of the constellation can be made out from the map. The star ϵ is a very fine double, observable with a small telescope.

South of this is Virgo, a large group containing one bright star, Spica, and another fine double star, γ, which is binary, the two components moving about one another in an elliptical orbit with a period of about 180 years. West of this is Leo, with another first-magnitude star, Regulus. The star γ in this constellation is again a fine double.

Below these groups is the long stream of stars which belong to Hydra. They stretch out fully 90 deg. from the west to the south. The Cup (Crater) which stands on the Sea Serpent's back, is not prominent, but the Crow (Corvus) is a small but conspicuous group, in which the star δ is an interesting double.

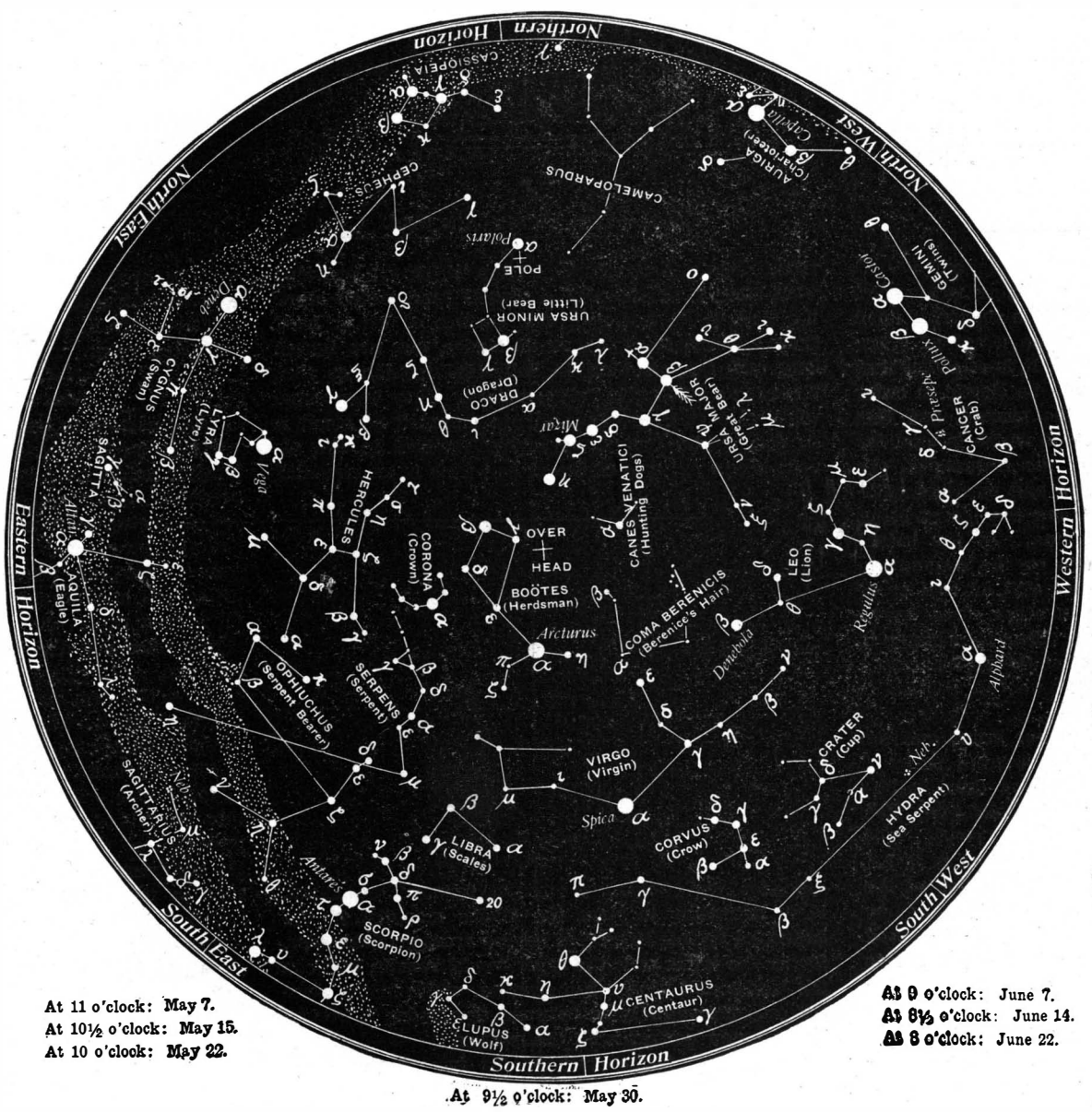
Northwest of the zenith the Great Bear appears to advantage. The star (named Mizar) at the bend of the Dipper Handle, has a fifth-magnitude companion visible to the naked eye, and another, at about 1/50 the distance of the first, which, like those of the double stars previously mentioned, can be seen only with telescopic aid. Recent spectroscopic work has shown that both these companions, as well as Mizar, are themselves double, and in rapid orbital motion, though these pairs are far too close to be separated by any telescope.

Between the Great Bear and Virgo lie two small constellations. The Hunting Dogs (Canes Venatici) have only one bright star (another fine double). Coma Berenicis, to the southwest, consists of a cluster of faint stars, just separately visible to the naked eye.

Cancer, Gemini, and Auriga are setting in the west and northwest. Jupiter is now in the first of these constellations, and Venus in the second. The two planets are not far apart, and they are by far the brightest objects in sight. Of the circumpolar constellations, Cassiopeia is low on the horizon, Cepheus above, and Draco and Ursa Minor above the pole.

In the northeast Cygnus has risen, and Lyra is above it. The latter contains the great white star Vega, which almost equals Arcturus in brightness. Between Vega and the latter are the constellations Hercules and Corona Borealis. The "keystone" formed by the stars ζ, μ, π, and ϵ in the former, and the semicircle which contains all the principal stars of the latter, are easily recognized. South of these are Ophiuchus and Serpens. The figures of the Serpent and his Bearer are not unnaturally much intertwined, but the map will help us to separate them.

Lower down is Scorpio, one of the finest constellations in the sky. The vertical row of three white stars, β, δ, π, is followed by a nearly horizontal row of three, of which the middle one is the fine red star Antares. Below this is a long line of stars which form the Scorpion's tail, but have as yet only partly risen. Scorpio is full of fine double stars. Antares has a faint green companion, too close to be easily seen unless the air is steady. The stars β and γ are also fine doubles, and μ, below Antares in the tail, is a fine naked-eye pair.



At 11 o'clock: May 7.
At 10½ o'clock: May 15.
At 10 o'clock: May 22.

At 9½ o'clock: May 30.

At 9 o'clock: June 7.
At 8½ o'clock: June 14.
At 8 o'clock: June 22.

NIGHT SKY: MAY AND JUNE

THE PLANETS.

Mercury is evening star throughout the month, and can be well seen in its early days about the time of his elongation, which takes place on the 7th. At this time he is in Gemini, and sets about 9:10 P. M. He is lower down than Castor and Pollux, which are the only objects for which he might be mistaken.

Toward the end of the month he gets quite close to Venus, within two or three degrees, and the two planets remain in apparent proximity for several weeks, during most of which time, however, they are too near the sun to be well seen.

Venus is likewise evening star, and is very conspicuous at the beginning of the month, when she sets after 10 P. M. Later on, as she comes more nearly between us and the sun, she is less easily seen, and by the end of June she becomes practically invisible, to reappear as a morning star in a few weeks.

Throughout the month she appears telescopically as a narrow crescent, whose apparent diameter is greater than that reached by any other planet.

Mars is likewise an evening star, in Gemini, and sets at about 9 P. M. in the middle of the month. On the 6th he is in conjunction with Mercury. The least distance of the two planets, 19 minutes of arc, is reached near noon, when they cannot be seen, but they will still be very close that evening. Mercury, which at this time is moving eastward and overtakes Mars, soon turns back, and passes him again on the 17th, and Venus, which follows Mercury, passes Mars on the 22d. All three planets are close together for a week or more, and they will afford a very interesting sight. Jupiter likewise is an evening star, but is higher up than the others, and sets at about 10:30 P. M. on the 15th. Saturn is a morning star in Pisces, and is observable before sunrise. Uranus is in Sagittarius, approaching opposition, and Neptune in Gemini, too near the sun to be observed.

THE MOON.

First quarter comes at midnight on the 6th, full moon at 9 A. M. on the 14th, last quarter at midnight on the 20th, and new moon at 11 A. M. on the 28th, during the eclipse. The moon is nearest us on the 20th and farthest off on the 4th. She is in conjunction with Mars and Neptune on the 1st, Venus on the 2d, Jupiter on the 3d, Uranus on the 15th, Saturn on the 21st, and with Neptune, Mercury, Venus, and Mars on the 30th (all being then too near the sun to be seen).

There is an eclipse of the sun on June 28, visible throughout the United States as a partial eclipse. In the line of central eclipse, where the moon appears exactly in front of the sun, the annular phase may be seen. At this time the sun, whose apparent diameter is greater than the moon's, sticks out as a narrow ring all around the latter. This phase is visible from the city of Mexico, Tampa, Fla., and Bermuda.

In the northern United States a large partial eclipse will be observed, the fraction of the sun's diameter covered by the moon ranging from about one-third for observers in Washington and Oregon to almost the whole in the Gulf States. At Washington, D. C., the eclipse begins at 9:27 A. M. and ends at 12:41, and about three-fourths of the sun's disk is hidden, at the maximum phase. This eclipse, while of little importance to the professional astronomer, since the sun will not be completely hidden and the corona cannot be seen, will be of much interest to the amateur observer. A piece of smoked glass is all that is required to observe it.

Princeton University Observatory.

An official return recently issued by the Board of Trade shows that the total number of persons killed on railways in the United Kingdom in the course of public traffic during the whole year 1907 as reported to the Board of Trade was 1,117, showing a decrease of 52 compared with the previous year, and the number injured 8,794, an increase of 1,582. The number of passengers killed was 120, a decrease of 46 compared with the preceding year, and the number of passengers injured was 2,663, an increase of 83. With regard to the servants of railway companies or contractors, the number killed was 454, an increase of 16, and the number injured 5,804, an increase of 1,439. Trespassers (including suicides) accounted for 447 deaths, compared with 455 in the previous year, and 133 cases of injury, compared with 106.

AUTOMOBILE SLED FOR DR. CHARCOT'S EXPEDITION.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The expedition which is headed by Dr. Charcot, the eminent French explorer, will leave for the Antarctic regions on the vessel "Pourquoi Pas" on the 15th of July. It will be remembered that the expedition is under the patronage of the French government and of the Académie des Sciences. Not the least interesting part of the outfit is the new type of motor-sled which was built for this special purpose at the works of the De Dion Automobile Company at Paris. Such a sled will be a great advantage, and the party expect to take three of them on board. The use of dogs for drawing the sleds is often a great disadvantage. Twenty-two dogs were taken on board the "Discovery" in a preceding expedition, and only three or four survived.

In order to make a practical trial of the sled, it was taken to the Lauteret Pass, in the heart of the Alps, and was run over hard and soft snow. A great speed is not desired, as crevasses are to be feared, and the sled must be quickly stopped. Dr. Charcot was greatly pleased with the results of the tests, which were carried out at 7,000 feet altitude.

The propelling machinery is mounted upon the ordinary type of Norwegian sled, such as is used by explorers and drawn by men or dogs. It is composed of two long flat runners about ten feet in length and four inches wide, with the axes of the runners spaced twenty inches apart. Above each of the runners is mounted a side-bar of the same length, which is supported upon the runner by short uprights, while a set of cross-bars serve to connect the runners. It is essential that the ensemble of the chassis should be elastic in order to follow the irregularities of the ground, and this elasticity is obtained by the method which is used for attaching the different pieces of the framework, the assembly being made with tenons and mortises without the use of glue or screws, and the pieces being held together by a flexible binding. At the points where there is the greatest strain on the framework, strips of chrome-leather, or, better still, of seal or of reindeer leather are used, and in other cases tarred cord is employed for the binding. Thus the chassis is extremely simple, and on account of the material used it is easily repaired. Such a frame can support a weight of 800 pounds.

On the frame is mounted the motor group and the driving wheel, which are the two essential parts of the mechanism. The power for driving the wheel is derived from a 2¾-horse-power, air-cooled De Dion gasoline motor having a 3-inch bore and stroke. The carbureter is supplied with warm air from a jacket surrounding the muffler. The speed regulation of the motor is effected by varying the ignition and by changing the air inlet of the carbureter. A speed changing box having gearing for two different speeds is combined with a special set of reduction gearing for the driving wheel. This wheel has spiked teeth which catch in the ice so as to drive the sled. The speed of the sled can be varied from one to six miles an hour. With the group are also mounted the gasoline and oil tanks, the latter being provided with an oil pump for lubricating the motor; other accessories include a spark coil and battery. To protect the parts from the snow, there is placed beneath them an apron of very solid leather, and the sides and top are covered by a hood of stout canvas which is easily removed. The motor group has a three-point support on the chassis so that it will not receive the deformations of the latter, and by taking off the screws the whole group is removed. It is quite necessary to have the parts thus removable owing to the great difficulty of working with the parts in these regions.

It was necessary to design a propelling device for the sled which should be able to work on ice or hard snow as well as upon soft snow. The driving wheel with paddle blades, which is sometimes recommended for this purpose, will only give good results upon ice and hard snow and on condition that there is no fresh snow upon the surface, for with this type of wheel the loose snow soon clogs up the space between the blades and makes it useless. After some trials, the designers decided upon a new form of driving wheel, taking into account the advice of Dr. Charcot. This new wheel is made up of two parallel rings 2 inches wide, which are mounted on the same axle and spaced about a foot apart. On these rings are fitted metal tires which are provided with steel projections of a special kind which allow the sled to be run upon the surface of ice or hard snow. These teeth, or small blades, are two inches long and are mounted in helicoidal fashion so that there is no continuity between them. They have somewhat of a cutting edge and are mounted at about a 45 deg. angle, though oppositely inclined in the inverse sense on each of the rings. This is an essential condition for securing a straight forward movement. It is necessary to have the blades mounted in the helicoidal system instead of having cross paddle-blades, for in the latter case the snow would remain between the blades and hinder the running, while in the present case the snow lying between the blades is broken by each new contact with the surface.

Seven wood frames connect the two rings. These are covered with a cord network somewhat after the manner of snow-shoes, and thus form a kind of cylinder which assures the propulsion when working upon soft snow. The driving wheel thus works on ice and hard snow by means of the toothed wheels, and upon soft snow by the "snow-shoe" frames. This wheel is mounted on a hinged frame so that it can follow all the irregularities of the ground or can be sunk below the surface to the right amount for giving the adherence. The latter is obtained simply by the weight of the wheel, excluding all springs, which are a complication and are likely to break in the cold. On the front end of the wheel frame is a slide which works in a grooved piece mounted on the back end of the provision case, so as to keep the frame straight.

The trials which were made with the new motor-sled at Lauteret were quite successful. Our engraving shows Dr. Charcot mounted in the rear back of the motor, while a second person is seated in front upon the provision box. The sled could run very well upon hard snow, with the motor giving but two horse-power on account of the altitude, and besides the two persons it carried a third drawn upon a sled which was hitched behind. Such a conveyance is not expected to make high speed, but in the present case it covered six miles an hour, which is a good figure. The total weight of the apparatus in running order is 460 pounds. It also made a very good performance when running upon soft snow. According to these results it cannot be doubted that a practical form of automobile sled has now been constructed, and it will no doubt prove of great value in exploring work.

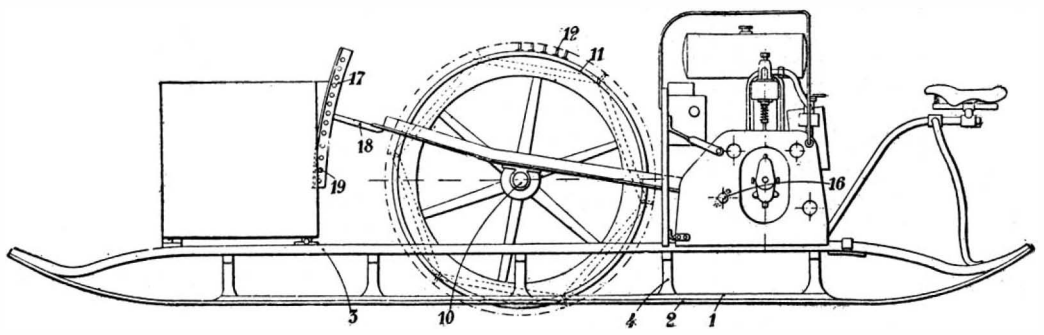


Fig. 1.—Side View of the Sled.

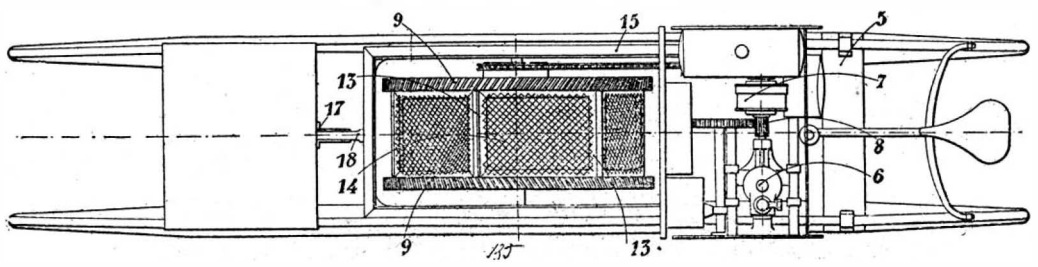


Fig. 2.—Plan View of the Sled.

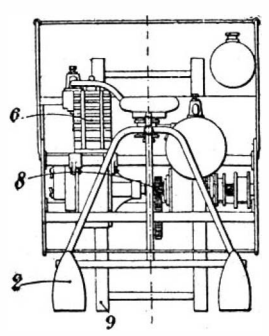


Fig. 3.—Rear Elevation.

DR. CHARCOT'S MOTOR-DRIVEN SLED FOR ARCTIC EXPLORATION.

The eminent explorer is seen in his shirt sleeves in the chauffeur's seat.

Heat Stresses and Cracks.

While cracks in cast iron, says Mr. Carl Sulzer, can usually be quickly seen, this is not the case with the tougher mild steel. There such cracks are only formed gradually, and frequently repeated action of these destructive stresses is necessary until finally the flexible material gives way. The writer investigated a typical case of this kind, where a fire-tube boiler failed. This boiler had been forced far beyond its normal capacity for a long time. Cracks appeared in the boiler plate which were not due to tensile stresses due to steam pressure. Assuming a difference in temperature of between 360 deg. and 720 deg. F., an elastic limit for the material for tension and compression of 22,000 pounds per square inch, and a modulus of elasticity of 28,400,000 pounds, the expansion will amount to 0.00075 of the length. The sum of the expansion and contraction (0.0015 of the length) is equal to the linear expansion due to the difference in temperature. Since the coefficient of expansion of mild steel for the difference in temperature, 180 deg. F., amounts to about 0.0015 of the length, therefore when the difference in temperature reaches 180 deg. F., the boiler plates are stressed beyond their elastic limit for tension or compression. A higher difference in temperature causes a corresponding excess over the elastic limit and a frequent repetition of this occurrence, without doubt, leads to the gradual formation of cracks. The question arises whether steel makers cannot produce boiler plate which will better withstand such an excessive strain. The foregoing facts show that better material in the sense of being better able to resist such stresses should have a higher elastic limit or smaller modulus of elasticity. A decrease in the modulus of elasticity is equivalent to decreasing the tensile strength of a material which has a certain ductility or percentage elongation.

The Dominion House of Commons has unanimously passed the following resolution: "The government should, on account of the rapid development of Western Canada and the continued inadequacy of the existing transportation facilities, take early action toward the construction of a railway to Fort Churchill, on Hudson Bay."

THE BRITISH "DREADNOUGHT" CRUISERS.

BY PERCIVAL A. HISLAM.

The three British "Dreadnought" cruisers of the "Inflexible" type are now rapidly approaching completion, and the first, the "Indomitable," has already carried out her gunnery trials under the supervision of the staff at Whale Island. The "Inflexible" cruisers are the first vessels of their class to carry a one-caliber armament, and in other respects they differ widely from the standard type of their predecessors. Their displacement, 17,250 tons, is larger than that of any completed battleship with the exception of the "Dreadnought," and their designed speed of 25 knots is equal to that of any sea-going vessel with the exception of the American scout cruiser "Chester," which made 26.52 knots on her trials. In anything of a sea the heavier vessel would, of course, be at a considerable advantage over the "Chester," so that it may safely be said that the "Inflexibles" are the fastest sea-going ships in the world.

The "Indomitable" is the only one of the trio to be completed within contract time—which was thirty months from the awarding of the contracts in November, 1905—and the finishing of the "Inflexible" and "Invincible" will probably be still further delayed by the shipbuilding lockout which commenced in the north of England on May 2 last.

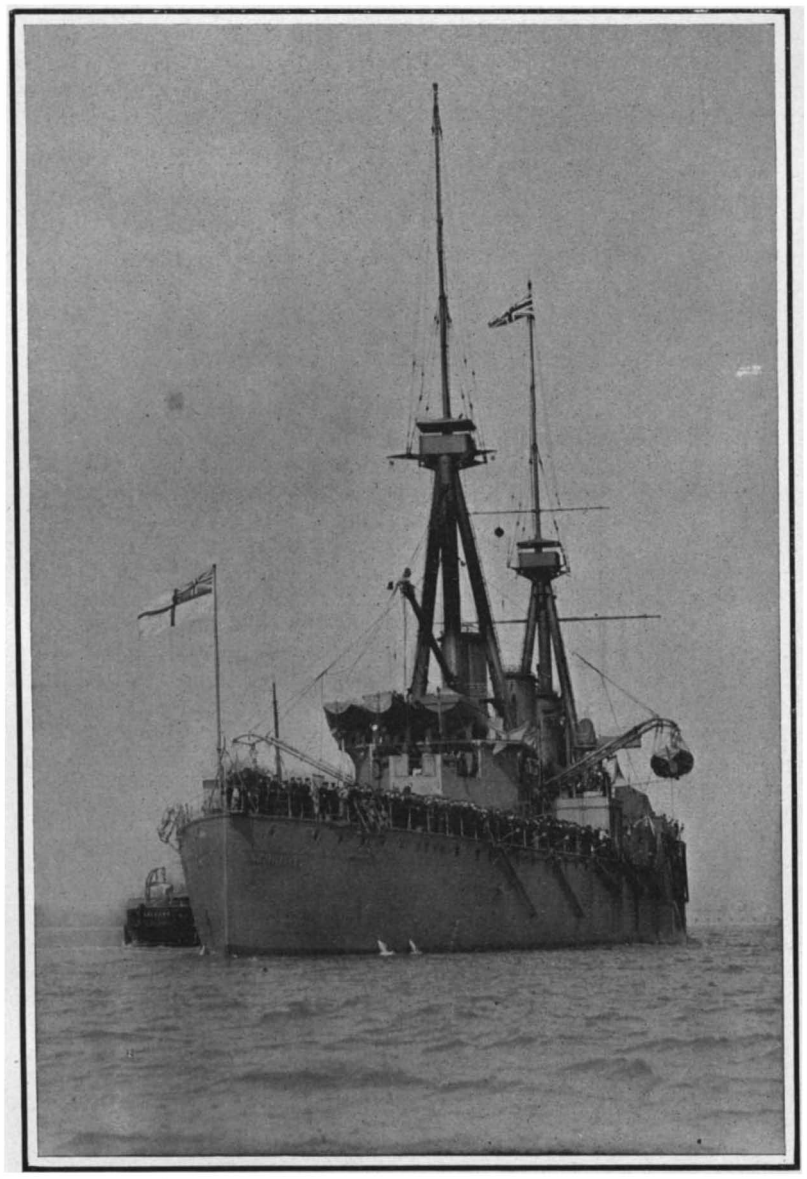
The "Indomitable" (the dimensions for all are the same) has a length between perpendiculars of 530 feet, and over all of 562 feet. The beam is 78 feet 6 inches, and the mean load draft 26 feet. At this draft the ship will be carrying 1,000 tons of coal or oil; the maximum fuel capacity is 2,000 tons, and the full load draft about 29 feet.

All three vessels will be driven by Parsons turbines, the estimated horse-power being 41,000. In the "Indomitable" this is obtained with natural draft, but in the others forced draft is to be applied. The contract speed is 25 knots. It is impossible to say what speed the "Indomitable" attained on her trials, as all the details are being very carefully guarded by the British Admiralty; but it is stated that 27 knots was maintained for eight hours on the full-speed run.

The armament of the "Indomitable" consists of eight 12-inch Mark X guns, so disposed that all can be fired on either broadside and six ahead or astern. Two of the guns are mounted in a turret forward on the forecastle deck; four are mounted in two turrets arranged diagonally amidships on the same deck. The other two guns are carried in a turret on the quarter deck. The freeboard forward is about 32 feet; amidships, 29 feet; and aft, 20 feet. In actual fire, therefore, the "Indomitable" is equal to the "Dreadnought," which has ten 12-inch guns; but the battleship has the advantage of two guns in reserve as it were on the unengaged broadside, or available to bring to bear against an enemy on that broadside. The weight of the broadside discharge is 6,800 pounds, with an aggregate muzzle energy of 318,774 foot-tons. The perfection which has been attained in the working and control of the gun turrets is remarkable. With the aid of an ingenious device the gun-layer can follow his object at a creeping pace, almost imperceptible, and yet in an instant can begin to run through the whole arc of training with great rapidity, without the slightest undue pressure on the turret system or the liability of sudden loss of control, even in the roughest seaway. A new motor system for turning the turret has proved a marked advance on the old type of turning engine.

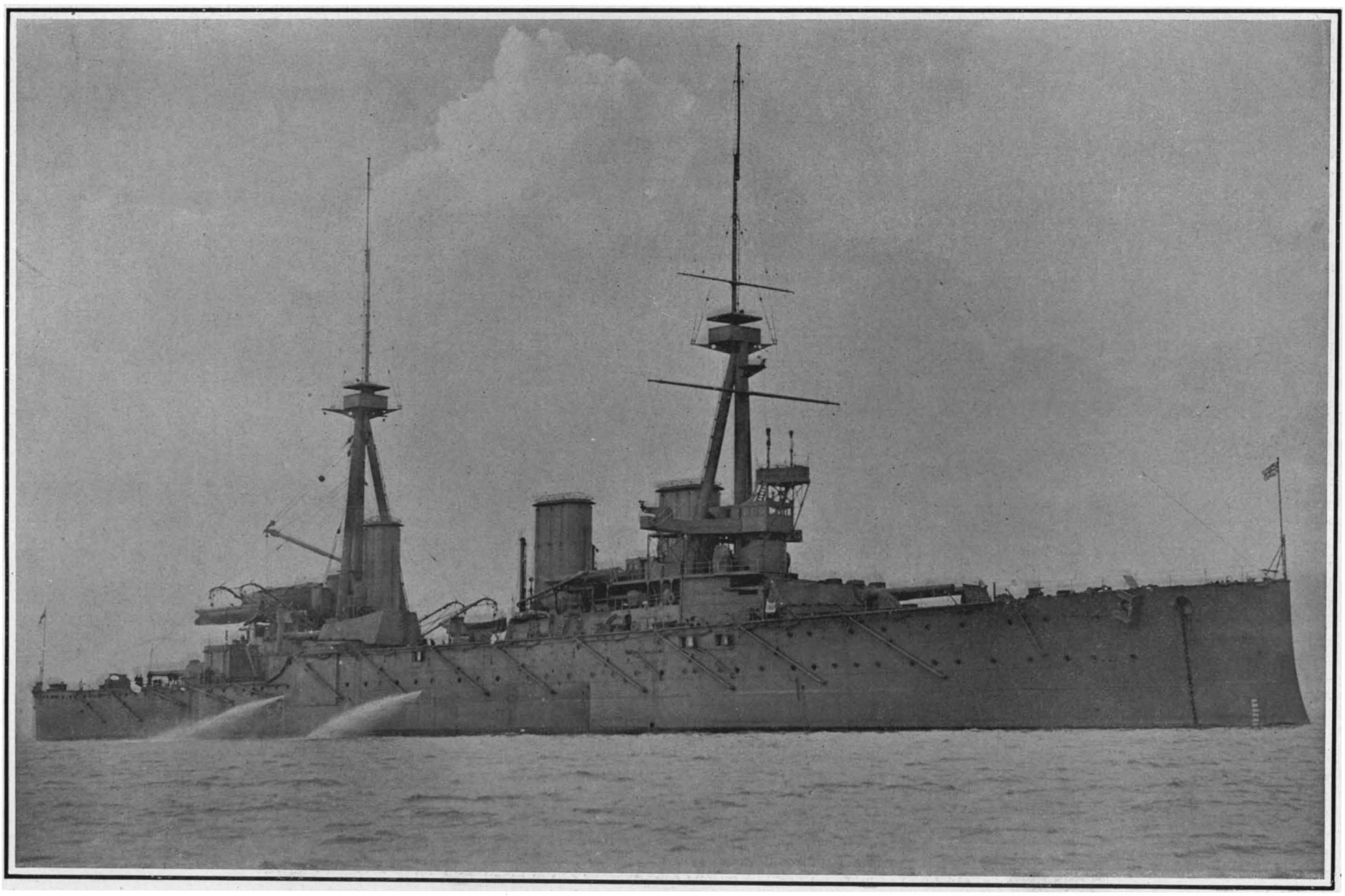
Special attention has been paid to the facility with which the 12-inch ammunition supply can be maintained under unfavorable conditions, and to the rapid replacement of damaged parts. The communication and control systems, which are invariably a source of trouble in warships, have been so designed as to give an application of directness rarely obtained, and which must tend considerably to minimize their chance of rupture, and greatly facilitate their rapid repair when the need arises.

The "Indomitable" is the first warship to adopt the "ring" system of wiring for electrical purposes, thereby effecting a considerable saving of space and weight. By this method it is claimed many defects will be avoided, others partially remedied, and all cable faults more readily located and their repair more simply effected.



The square structure below boat davits is a temporary tank for measuring water on trial trip.

Stern View. Note the Two Tripod Masts.



Length, 560 feet. **Displacement,** 17,250 tons. **Speed,** 25 knots. **Coal,** 2,000 tons. **Side armor,** 7 inches. **Armament:** Eight 12-inch; sixteen 4-inch guns.

New 25-Knot British Cruiser "Indomitable."

THE BRITISH "DREADNOUGHT" CRUISERS.

The anti-torpedo armament consists of sixteen 4-inch 25-pounder guns, disposed two on each turret and four on each shelter deck. In this respect the "Indomitable" is superior to the "Dreadnought," which has only 12-pounders for the purpose.

The gun trials of the "Indomitable" were by no means so severe as those to which the "Dreadnought" was subjected, the latter being, indeed, the most severe on record. The hull was, however, subjected to some very severe blast trials, and came through them undamaged. A wooden cutter, however, lying in the wake of the blast from one of the heavy guns was splintered into fragments. Three rounds with full charges and one with a reduced charge were fired from each 12-inch gun, and each turret fired a simultaneous round from both guns at extreme elevation with the recoil shortened. The mountings stood this test very successfully.

The protection of the "Indomitable" consists of a wide belt seven inches thick, but the side above the belt is only one inch thick. The belt tapers to four inches at the ends. In these cruisers, as in the "Dreadnought," the officers are quartered forward and the men aft.

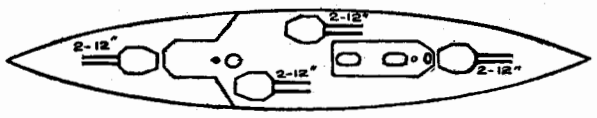
Is Space Curved?

BY J. F. SPRINGER.

The greatest monuments of scientific effort remaining to us from the ancient world are no doubt the Logic of Aristotle and the Geometry of Euclid. For more than two milleniums the latter has been admired and studied. Nearly all of our most modern text-books on the subject follow very closely the system and methods of the great geometrician of the third century B.C. What he assumed as fundamental and irresolvable is, generally speaking, still so regarded. But in this most rigorous and exact body of ancient science are two serious defects. Of these, the eleventh axiom is very celebrated. It is to the effect that one, and but one, straight line can be drawn parallel to a given line through an exterior point. Even in ancient times it was felt that, while this was a true proposition, it was by no means obvious, as an axiom should be. Repeated and strenuous efforts have been made to supply a proof. Some of these attempts were made by men of very high attainment. But it would seem, none of these has been successful. In fact, it appears hopeless to expect a proof based merely on the other axioms and definitions. It would thus appear to be independent of them. Finally, the axiom itself has been questioned. In 1829 Lobatschewsky made this bold step, denied the truth of the axiom, and developed upon this basis a system of geometry consistent with itself. But the truth of the axiom may be denied in more than one way. Instead of assuming—as Lobatschewsky did—that more than one parallel could be drawn to a given line through an external point, we may take the ground that no parallel at all is possible.

At first blush, this may appear preposterous in the very highest degree. But let us examine more closely. Suppose a population of intelligent beings to be confined to a portion of the surface of a sphere. Further, we will assume that neither these beings nor their world has any appreciable thickness. The whole will constitute, then, a universe in two dimensions. Such beings would have no straight line in our sense. Nevertheless, within the limitations of their world, they would have a very exact substitute. For them, the shortest distance between two points would be the arc of a great circle—that is, of a circle whose plane passes through the center of the sphere from which their surface is taken. This would be their "straight line." Euclid's eleventh axiom would to their minds be untrue, for parallels would have no existence in their world.* With us the sum of three angles of a triangle is invariable, being always equal to two right angles. With them the angle-sum would always be greater than that amount, depending on the area of the triangle—the larger the triangle, the larger the excess. A corollary of this is that similarity between triangles of different sizes would be impossible; the angles of the larger could not all be equal to the corresponding angles of the smaller one, for the angle-sum would have to be greater. This leads directly to the proposition that they would know nothing of sameness of shape combined with difference in size. In their world, children would differ frightfully from their parents. Such would be their universe and their knowledge. To us, their contention that the shortest distance between two points is what we know as the arc of a great circle would appear preposterous. And yet it would be the logical result of the limitations of their world. We know an infinite number of more direct, that is shorter, paths. For every circumference passing through the two points and whose radius is greater than that of the given sphere would yield such a path. None of these would, however, be within their world, and so all would be beyond their knowledge. If they could step out of their limitations of an existence of two dimensions into our world of three dimensions, they would perceive these other shorter lines. In fact, they would perceive that their "straight line" is curved in the direction of a third dimension, and that this curvature is invisible to those dwelling on the spherical surface. Among these shorter lines, however, they would find one minimum—our straight line. Having experienced such results from the passage of their two-dimensional space into one of three dimensions, they might readily be excused if they considered whether there might not be a four-dimensional universe, the passage into which would disclose that this line which we so confidently call "straight" is in reality curved, but in a direction invisible to our minds, limited to the experiences of but three dimensions. This would appear to be very strict analogical reasoning—not conclusive, of course, nor having, it may be, a high degree of probability. They saw how, in our world of three dimensions, we possessed an infinity of paths connecting the two given points, all of which lines are shorter than their minimum line. They might infer from this, then, that in four-dimensional space there would be one single shortest line, absolutely straight—unless curved in a still higher dimension. If they made comparisons between the lengths of their "straight line" and ours, they might readily expect that in the space just higher than ours two of our points might be not only nearer, but considerably so. Thus New York and Constantinople, which are distant, on the surface, about 5,400 miles, but by a straight line through the crust of the earth about 4,700 miles, might in reality be no more than 4,000 miles or even less from each other, if the measurement were made along a line which was the shortest path in a world of four dimensions.

Again, we may suppose that our surface dwellers had investigated their own world sufficiently to learn that their "straight lines" returned to themselves, so that an individual setting out in any given direction and pursuing it without deviation would come back to the starting point. Their expectation then, upon being awakened to our world, might reasonably be that our straight lines might have the same property. If their telescopes were sufficiently powerful in their space, they would be able, as I think some one has suggested, to see the backs of their heads. And so they might look for similar results with us. Notice, that



Deck Plan of the "Indomitable."

in order to secure this result it would not be necessary for them to know anything about a third dimension. A telescope pointed in any one of their directions would be successful, if powerful enough.

Now, while their "straight lines" cannot be parallel, still at a distance from their intersections they might appear so to one possessed of means of measurement somewhat inexact. This raises the question whether our parallel "straight lines" are absolutely so, in fact. If measuring instruments of an extreme degree of refinement should disclose that we have parallels which are not everywhere equally distant, then the troubles of geometericians as to the eleventh axiom of Euclid would, from the point of view, be over. It would be shown to be untrue.

Now, since on a sphere no two parallel "straight lines" can be drawn, if it shall hereafter appear absolutely certain that we have *some* parallel straight lines, this would be sufficient to differentiate our space from the analogue of spherical space of two dimensions. However, there are different styles of bending, and while our space may not have a sperical curvature, it may possibly have a different sort.

Now, on the surface of the sphere the inhabitants might find out that more than one "straight line" could be drawn connecting two given points. They could scarcely have found out this, however, without having extended their experience to a complete circuit of their space—the second line being, of course, the remainder of the great circle. Supposing, now, that this had been ascertained, they would be surprised that with us but one straight line connected two points. They would, however, naturally expect that this was simply due to the incompleteness of our knowledge, to our space's not having been sufficiently explored. They would also be surprised, no doubt, that we regarded the angle-sum of triangles as invariable. Since with them the triangle-sum increased with the size of the triangle, they would probably think that when we had investigated sufficiently large triangles we should find the sum of the three angles larger than two right angles.

It may be inquired right here, whether there have been found in the course of scientific exploration and research any indications confirmatory of the hypothesis of space which is curved in a fourth dimension. To this must be answered, No. There are mysteries in science which four-dimensional space might conceivably tend to solve. But hard-headed thinkers will want something more convincing than this before their consideration becomes anything more than good-humored tolerance. However, one of these mysteries is as to the method of action of gravitation. The *law* of its action is well known. Schoolboys, in fact, know that it varies directly with the mass and inversely as the square of the distance. But this is merely descriptive, and gives no insight into the mystery of *how* the attraction is accomplished. How, for instance, does the sun, ninety-five million miles away, exert any force whatever upon the earth? This is the mystery of action at a distance. But if, in reality, there is a fourth dimension in the direction of which our space is so curved that the sun and earth are actually in contact, the enormous apparent distance being due to our measurements being taken under the limitations of three dimensions, then this riddle of the action of gravitation would disappear.

If one seeks for confirmation, he might suppose that this would be furnished by astronomy. Thus we might expect that in such an enormous triangle as would result from connecting the members of a group of three fixed stars, we should have reached the point where the angle-sum might be expected to vary from two right angles. But as we look into the methods to which astronomy is at present limited, we shall readily see that we can obtain no assistance here. Thus, it would be possible to observe a star simultaneously from opposite sides of the earth, and ascertain the base angles of the triangle whose base connects the points of observation and whose vertex is the star. But the angle at the star is beyond direct measurement. The method, at present, would be to add the base angles and subtract from the angle sum (180 deg.). But this method assumes the invariability of this angle-sum. To determine the question, we should have to set up one instrument on the star itself, and make observation of the angle subtended by the terrestrial diameter. The obvious objection to this, that we could not distinguish the ends of such a small length as the diameter of the earth, could be met by replacing the small base line by the 190-million-mile diameter of the earth's orbit, taking our observations six months apart. But the difficulty of making the observation from the star itself could not be met.

* There would be, of course, parallel small circles, just as we have parallels of latitude. But parallel "straight lines" would be impossible. They would have the anomaly of a "straight line" having a parallel which is not "straight." Our equator and a parallel of latitude constitute an illustration of this.

Radio-Activity of the Leaves of Conifers.

Costanzo and Negro discovered some time ago that leaves of plants placed in the cylinder of an electroscope used in researches on radio-activity gave to the air within the apparatus a certain conductivity, or in other words, ionized the air. They then undertook a more profound study of the phenomenon, using leaves of *Cedrus deodara* and *Cedrus Libani*. Their results are reported in the memoirs of the Accademia dei Nuovi Lincei. With the leaves of these species the ionization of the air, which is a maximum immediately after their introduction into the apparatus, diminishes very rapidly. Dr. Russell had already proved that the wood and resins of conifers and various other trees have the property of affecting photographic plates, and that one could thus obtain, by contact in the dark, very fine photographs showing the alternate light and dark rings and lines produced in the wood in spring and autumn. Nevertheless it is not evident that this effect is attributable to the radio-activity of the wood, for a thin sheet of glass or mica interposed between the wood and the sensitive plate prevents the action entirely. Carnazzi has undertaken a study of the ionization of air by resins.

The Current Supplement.

There was successfully launched at the Brooklyn navy yard on May 19 the first collier to be built especially for the service of the navy. This vessel is described in the current SUPPLEMENT, No. 1691, and her launch pictured. The nitrogen problem is once more agitated by George M. Heath. In an excellent paper he carefully summarizes all the attempts which have been thus far made to extract nitrogen from the air for agricultural and other uses. The eighteenth installment of Prof. Watson's "Elements of Electrical Engineering" is published. The subject discussed is current reorganizers. Some late improvements in compressive riveters are described by Chester B. Albree. The Austrian coefficients for the transmission of heat through building materials are discussed by W. W. Macon. James L. Davis writes on the waterproofing of cement structures. Many parts of this country have been generously endowed by nature with striking and curious natural monuments. Some of these are illustrated and described by Charles Goodman. Prof. Edmund Beecher Wilson sums up the researches which have been made by modern biologists, and discusses with simplicity the work of Mendel and his school. The various forms of buoys and beacons used throughout the world are described by Max Buchwald. William P. Seal contributes an article on fishes in their relation to the mosquito problem.

Correspondence.

A Very Simple Mode of Making Magic Squares.

To the Editor of the SCIENTIFIC AMERICAN:

I have just read in your issue of May 2 a letter from Mr. Albert R. Gallatin in which he illustrates the well-known principle of "casting out the nines," as follows:

111 residue = 3
11 residue = 2
Product 1,221 residue = 6

the "residue" being the remainder after deducting the highest multiple of 9.

He ends his article by saying: "I should like very much to see an explanation of this remarkable property"; viz., that the residue of the product of any two numbers is equal to the residue of the product of the residues of the said numbers.

We will take any two numbers; $m + x$ and $n + y$. m and n are multiples of 9 and x and y are the respective residues. Multiplying, we have:

Residue of $m + x$ $= x$
Residue of $n + y$ $= y$

Residue of $m\,n + n\,x + n\,y + xy$ = residue of $x\,y$ Q.E.D. since the residue of each of the first three terms of the left side of the equation equals zero.

The rules of magic squares to which your correspondent refers as very abstruse may be very briefly stated and easily remembered; one of which I give herewith.

Start in the square next below the center, proceed diagonally downward and to the right one column at a time. When the last column is reached, begin afresh at the first (left or top, as the last happens to be the right or bottom, respectively). Whenever you find your next square taken, drop two squares below and proceed as before. This rule will work out a magic square of any number of odd figures, as 3, 5, 7, 9, to a billion and one. I give a few illustrations.

4	9	2
3	5	7
8	1	6

Adds 15 each direction.

11	24	7	20	3
4	12	25	8	16
17	5	13	21	9
10	18	1	14	22
23	6	19	2	15

Adds 65 each direction.

22	47	16	41	10	35	4
5	23	48	17	42	11	29
30	6	24	49	18	36	12
13	31	7	25	43	19	37
38	14	32	1	26	44	20
21	39	8	33	2	27	45
46	15	40	9	34	3	28

Adds 175 each direction.

37	78	29	70	21	62	13	54	5
6	38	79	30	71	22	63	14	46
47	7	39	80	31	72	23	55	15
16	48	8	40	81	32	64	24	56
57	17	49	9	41	73	33	65	25
26	58	18	50	1	42	74	34	66
67	27	59	10	51	2	43	75	35
36	68	19	60	11	52	3	44	76
77	28	69	20	61	12	53	4	45

Adds 369 each direction.

56	117	46	107	36	97	26	87	16	77	6
7	57	118	47	108	37	98	27	88	17	67
68	8	58	119	48	109	38	99	28	78	18
19	69	9	59	120	49	110	39	89	29	79
80	20	70	10	60	121	50	100	40	90	30
31	81	21	71	11	61	111	51	101	41	91
92	32	82	22	72	1	62	112	52	102	42
43	93	33	83	12	73	2	63	113	53	103
104	44	94	23	84	13	74	3	64	114	54
55	105	34	95	24	85	14	75	4	65	115
116	45	106	35	96	25	86	15	76	5	66

Adds 671 each direction.

79	164	67	152	55	140	43	128	31	116	19	104	7
8	80	165	68	153	56	141	44	129	32	117	20	92
93	9	81	166	69	154	57	142	45	130	33	105	21
22	94	10	82	167	70	155	58	143	46	118	34	106
107	23	95	11	83	168	71	156	59	131	47	119	35
36	108	24	96	12	84	169	72	144	50	132	48	120
121	37	109	25	97	13	85	157	73	145	61	133	49
50	122	38	110	26	98	1	86	158	74	146	62	134
135	51	123	39	111	14	99	2	87	159	75	147	63
64	136	52	124	27	112	15	100	3	88	160	76	148
149	65	137	40	125	28	113	16	101	4	89	161	77
78	150	53	138	41	126	29	114	17	102	5	90	162
163	66	151	54	139	42	127	30	115	18	103	6	91

Adds 1,105 each direction.

Louisville, Ky., May 1, 1908. F. L. SPEIDEN.

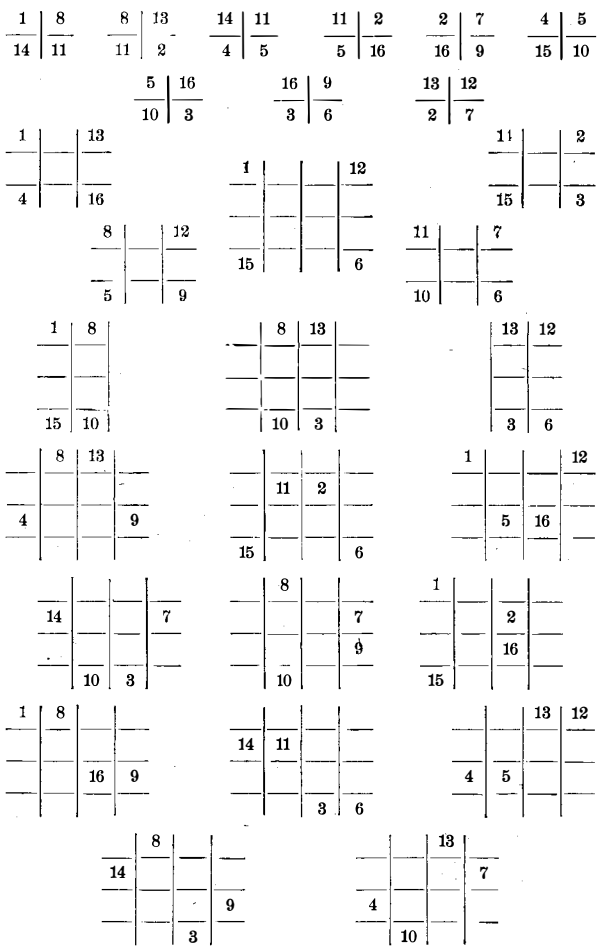
Another Magic Square.

To the Editor of the SCIENTIFIC AMERICAN:

The square shown below is made up of the numbers 1 to 16 which are so arranged that their sums vertically, horizontally, and diagonally equal 34, and any four numbers forming a rectangle within the square sum up to 34. The numbers are arranged in pairs following the move of the knight on the chessboard: 1 and 2, 3 and 4, 5 and 6, etc.

1	8	13	12
14	11	2	7
4	5	16	9
15	10	3	6

The following are some of the various ways in which the numbers may be added to equal 34:



In fact, the arrangements are endless. Observe, the arrangements are not chance, but follow definite rules. The square fairly yells 34 at you. It is one of the queerest freaks I ever stumbled over in my mathematical investigations. A SUBSCRIBER.

More Curious Facts About Figures.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of May 2 A. A. Laughlin, under the heading "Curious Facts About Numbers," shows that if we add the odd numbers beginning with 1, the sum is equal to the square of the number of numbers added.

This may be carried at least two steps farther; that is, we may derive all cubes and all fourth powers from this same series.

The first term of the series is the cube of 1. The sum of the next two terms ($3 + 5 = 8$) is the cube of 2. The sum of the next three terms ($7 + 9 + 11 = 27$) is the cube of 3, and so on. It will be found that the middle term in any addition or the even number between the two middle terms if the number of terms is even will be the square of the number to be cubed. So we may write the rule: The cube of a number is equal to the sum of a natural series of odd numbers whose number of terms is equal to the number to be cubed and which has for its middle term or includes between its middle terms the square of the number to be cubed.

Example: $4^3 = 13 + 15 + 17 + 19 = 64$. It will be seen that the two middle terms include 16, the square of 4.

To find the fourth power of a number, simply start with 1 and add all the odd numbers until you have a number of terms equal to the square of the number whose fourth power is to be found.

Example: $2^4 = 1 + 3 + 5 + 7 = 16$. The number of terms $= 4 = 2^2$.

It seems likely that higher powers can be derived from this series by somewhat similar formulæ.

Wheeling, W. Va. HENRY M. RUSSELL, JR.

It is reported that a student of the Electro-Technical Institute of St. Petersburg, named Freudinberg, has invented an apparatus for exploding mines by wireless telegraphy. Numerous experiments already made are said to have proved remarkably successful. The apparatus is also claimed to be suited for directing Whitehead torpedoes at long ranges.

Ancient Records Bearing on Alaska's Boundary.

Documents, which would have been of great importance at the time of the conference in London in regard to the Canadian boundary question, have been recently unearthed in Alaska by Leo Nebokoff, a friend of Count Leo Tolstoi. They are ancient Russian papers showing how Russia managed to lay claim to the entire northern coast of North America.

Nabokoff has forwarded some of the documents to the Governor-General of Canada and they will in all probability be exhibited in the Dominion building at the Alaska-Yukon-Pacific exposition, which will be held at Seattle in 1909, as they would have played an important part in the history of the countries the fair will be held to exploit had they been brought to light sooner.

It was while in Sitka, where he was sent by his government to put in order the archives kept by the Russian authorities, that Nabokoff discovered the papers. They were written in old Russian, which he had studied. One of the records was an order from the Russian government to the Czar's governor of Alaska to bury tablets bearing the Russian coat of arms at different points along the coast, which were to be carefully noted so that in after years when the country became valuable they could be dug up and used by Russia to claim the territory. This was done in part and the purport of some of the documents is that Russia appropriated the whole of the Alaska coast. Had these records been brought to light before the boundary decision some five years ago, they might have affected it, but now that the coast line is forever settled they are chiefly of interest as relics.

Nabokoff located some of the tablets and they will be secured for exhibition at the Alaska-Yukon-Pacific Exposition. They were buried as far south as British Columbia. Had they been unearthed and claim laid to that territory, the United States, by the purchase of Alaska, would now own the entire Pacific coast from Mexico to the Arctic Ocean.

The Use of Ozone in the Transportation of Live Fish.

Ozone is an energetic oxidizing agent which is continually finding new industrial applications. This allotropic form of oxygen is a bluish gas of strong and characteristic odor. Its density is 1.5 times that of oxygen, its molecular formula being O_3 while that of oxygen is O_2.

The oxidizing and germicidal power of ozone has been utilized in sterlizing air and water, aging liquors, preventing fermentation in fruit juices, refining sugar, and bleaching and preserving flour. It is also employed as an oxidizing agent in bleaching textiles, the manufacture of artificial camphor, artificial silk and dyestuffs, and in the preparation of certain oils. Ozone is usually obtained by the action of the silent electrical discharge on oxygen.

A new use for ozone has been found in the transportation of live fish. Fish decompose so rapidly after death that they cannot be transported to great distances without the use of refrigerator cars and great expense for ice or other refrigerants. Hence it is desirable to keep the fish alive during transit, but here another difficulty is encountered, for fish of the more delicate species soon die in tanks in which the water is not continually renewed.

In practical trials which have been made in France and other countries, however, it has been found possible to keep fish alive on long journeys by forcing a properly regulated stream of ozone into the water of the tanks in which they are imprisoned.

An international mining exposition will be held at Madison Square Garden from May 25 until June 20, 1908. One of the features of this exposition will be the installation of a complete mine, equipped with a cage, operated by electric motor, and those who desire can descend eighty feet and witness various "levels," "tunnels," "cross-cuts," "a stop," "winze," hanging and foot walls, and by an object lesson receive a lifelong impression of a very good representation of a gold mine. Another equally attractive demonstration will be the rock-drilling contest with hand drill and sledge. The miners in drilling for blasts become very proficient, as there are many existing conditions where there are no facilities to permit the use of power drills. These contests are so important, and such an exhibit of physical endurance and skill, that international rules are observed for governing them throughout the West. There will be exhibits in this line of down-hole, backhole, and uphole, which last being overhead, naturally requires greater skill and endurance. A somewhat pathetic and interesting deviation in this line will be a team of drillers from Butte, Mont., miners who lost their sight in a mine accident, but who were so proficient in their calling that they are still able to support themselves, although both are positively blind. Moving pictures of mining scenes will be exhibited in the concert hall. Many of the mining States are exhibiting their mineral resources. Carloads of mineral representing nearly every county in Nevada are now *en route* to New York.

FIRST FLIGHTS OF THE AERIAL EXPERIMENT ASSOCIATION'S SECOND AEROPLANE.

Although in its first test the second aeroplane to be constructed by the Aerial Experiment Association covered a distance of but 279 feet at a height of but about 10 feet, on May 18, this flight is considered by Dr. Alexander Graham Bell, and by Lieut. T. E. Selfridge, U.S.A., and the other members of the Association, to have been the first really successful flight of the second heavier-than-air flying machine of this particular pattern. A number of other aeronauts who are at Hammondsport, N. Y., where the tests are being conducted, and who are building other types of flying machines, gave praise to the new machine.

The Association's first aeroplane, the "Red Wing," which flew 318 feet above Lake Keuka on March 12 last, was illustrated in the SCIENTIFIC AMERICAN of March 21. This machine had a horizontal single-surface tail, which buckled in the first flight. The tail was changed to a double-surface box shape, like that used on the Farman aeroplane, and in a subsequent flight in the rain a few days later, the aeroplane tipped to one side and, crashing to the ice, was demolished.

The new aeroplane—the "White Wing"—is practically the same as the former one, save that it is mounted upon pneumatic-tired bicycle wheels instead of runners. A rectangular box tail has been fitted. For experimental purposes, so that the machine could obtain a start before ascending, a half-mile track was built. By running along on this track, proficiency in handling the steering gear and other mechanism was attained. In a trial on the ground the day previous to the successful ascent, a slight defect in the steering gear was detected and remedied. The experimenters had thought that the aeroplane could be guided by the rudder alone when running on the ground, but they found it was also necessary to turn the wheels. Besides the horizontal rudder in front for controlling the elevation of the aeroplane and maintaining its fore and aft equilibrium, there is the usual vertical rudder for side steering in the middle of the box tail, while in addition to this the wing tips are pivoted horizontally about their forward edges and made to move up and down slightly in turning a corner by means of a cord which runs through pulleys at the rear corners of the upper plane and which is attached to the aviator's body. The instinctive leaning to one side of the aviator in making a turn is thus used to set the wing tips properly.

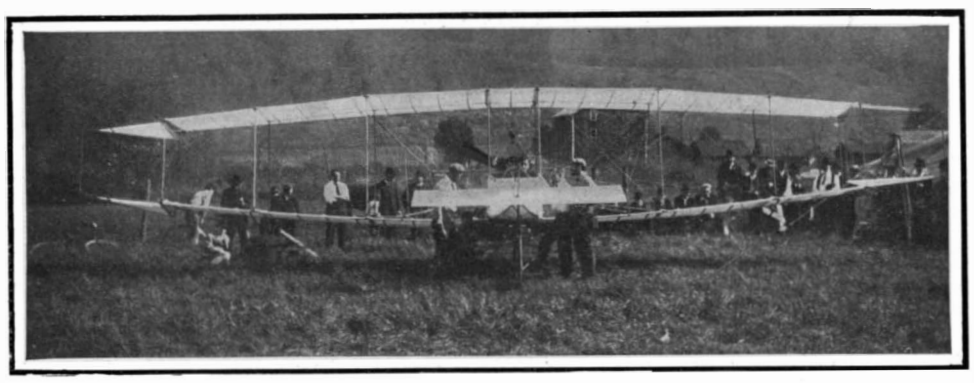
The new aeroplane has double superposed surfaces. There are two distinctive features in the design. The first is the general principle and arrangement of the truss which supports the two surfaces, and the second is the shape of the surfaces themselves.

In this machine the truss differs radically from ordinary designs, being a double bowstring truss, which was found to have structural advantages over the flat bridge design commonly used. The other features which distinguish the machine from the usual type of double-deck machines lie in the shape of the supporting surfaces, which are very much like a bird's wing in plan, tapering toward the tips, and at the same time decreasing in curvature.

A wooden propeller is used, with an eight-cylinder 40 horse-power Curtiss air-cooled motor. The propeller's diameter is 6 feet 2 inches. The pitch is about equal to the diameter. At about 1,200 R. P. M., with the motor developing 25 horse-power, the propeller develops some 245 pounds thrust. The aeroplane is 42 feet 6 inches long from tip to tip and 4 feet deep at the outside panel. It has a total supporting surface of 408 square feet, while its weight is 431 pounds.

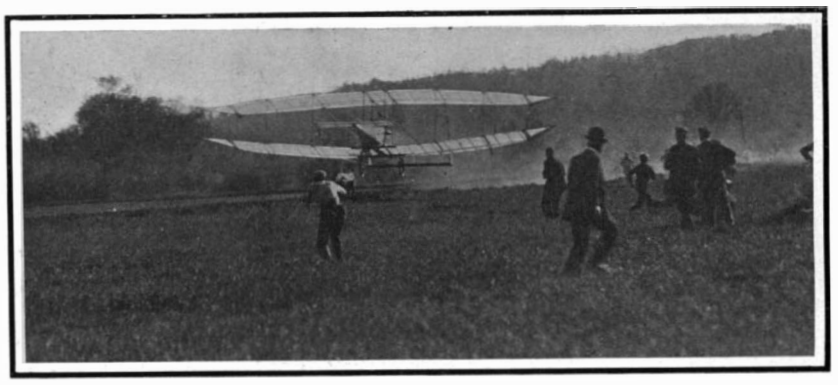
The flight on the 18th was an excellent one. The machine left the ground readily after a run of about 200 feet, and alighted at the end of the flight without serious shock. A good idea of its appearance in flight can be had from the photograph reproduced above, from which it can be seen that the transverse stability was apparently excellent. The propeller was slightly damaged during this flight, but repairs were soon made, and the following day two more short flights were executed. The first of these could hardly be called a test, as the machine remained in the air but two seconds and traveled about a hundred feet. When it descended on its wheels it ran 201 feet on the ground before stopping. In this run a guy wire broke, which impeded slightly the action of the propeller. In a few minutes the damage was repaired and the second ascent was made in a quite heavy rain. In a few seconds sufficient velocity was attained and a rapid rise was made to a height of 30 feet. The aeroplane then dipped slightly to the right, slowly dropped about 12 feet, and then came to earth. The front rudder wheel was broken considerably, and several hours were required to repair the damage. Notwithstanding this, Dr. Bell was pleased with the trial. Lieut. Selfridge acted as aviator on this day, while F. W. Baldwin piloted it on the first trial.

On May 22 Mr. G. H. Curtiss, after some changes had been effected in the new aeroplane, made an excellent flight which, although his first, is reported to have extended over a total distance of 1,017 feet, and to have been accomplished in 19 seconds, or at a speed rate of about 36½ miles an hour. During this flight the machine touched ground once after covering 615 feet, but it immediately rose again and continued in the air until the aviator caused it to land near the edge of a plowed field. Mr. Curtiss appeared to have excellent control of the aeroplane, which rose and fell during the flight, varying in height from 5 to 25 feet.



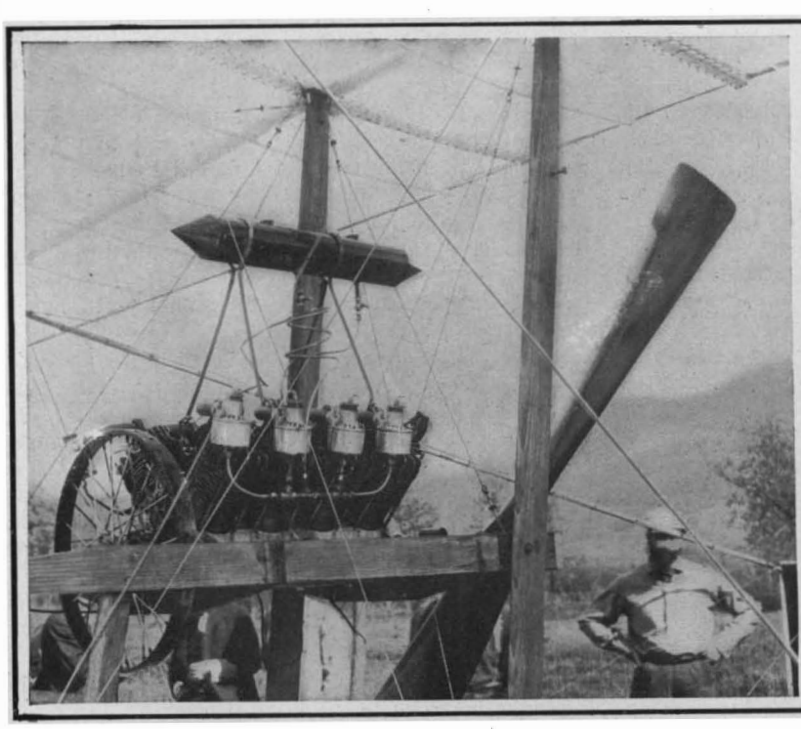
Front View of the Aerial Experiment Association's New Aeroplane.

The pointed wing tips have been made flexible so they can be twisted to aid in steering. The propeller and the frame of the box tail can be seen at the back, and the horizontal rudder in front.



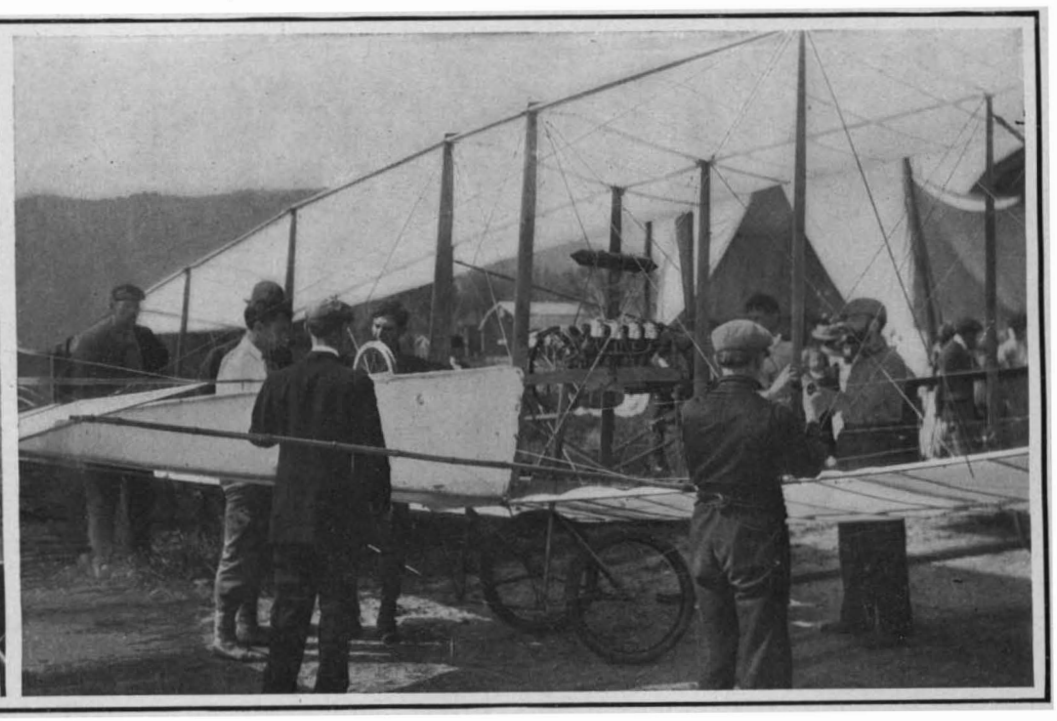
The Aeroplane in Flight.

The "White Wing" making its first flight of 279 feet at a speed of about 30 miles an hour.



The Motor and Propeller at the Rear of the Main Planes.

One corner of the rectangular box tail is visible at the end of one of the long bamboo poles which attach it to the aeroplane proper.



Three-quarter Front View of Aeroplane.

This view shows the horizontal rudder, the steering wheel, and the running wheels.

THE SECOND AEROPLANE OF THE AERIAL EXPERIMENT ASSOCIATION.

Finding the Specific Gravity.

The usual way of finding the specific gravity of an insoluble body is, as laid down in the text books and carried out in practice, to weigh the body first in air and then in water, find the difference in the two weights, and then divide the weight in air by that difference. Thus, a body weighing 10.32 pounds in air and only 1.25 pounds when fully immersed in water will lose $10.32 - 1.25 = 8.07$ pounds in weight when buoyed up by the water; its specific gravity will therefore be $10.32 \div 8.07 = 1.278$.

A better way is to weigh the object in air, then after immersing it in water and leaving the original weight untouched, to put in or on weights enough on the same side of the scale, with the object of bringing back the even balances. The weight in the second pan, or in the second case—which weight will naturally represent the loss of weight in water—divided into the original sum, to obtain the specific gravity.

Where possible, it is still more simple to weigh out in the first case a given even quantity of the material to be tested—as of potatoes or beets in beet-sugar or potato-alcohol manufacture; there being used for this purpose two baskets, one above the other, of which the lower one is completely immersed in water. The material being weighed in the upper basket while the lower one hangs free in the water, is then transferred to the lower basket, and the weight added on that side of the balance to restore equilibrium is divided into the original sum, to obtain the specific gravity.

As an example: 100 pounds of beets are weighed out in the upper basket and then transferred to the under one; then 87.5 pounds are added on the same side with the beets to bring back the equilibrium; then the specific gravity is $100 \div 87.5 = 1.14$.

In handling such materials as beets and potatoes, any that swim should be thrown out before weighing, as they are hollow and contain air, and are useless for industrial purposes.

THE WRIGHT AEROPLANE TEST IN NORTH CAROLINA.

Upon the return of the newspaper correspondents and photographers from North Carolina, considerable more information was obtainable regarding the recent flights made by the Wright brothers in testing their aeroplane than has hitherto been available. Unfortunately, not one of these men is a qualified technical observer, for which reason we are little better off for details than we were before.

In addition to the frontispiece showing the aeroplane as it appears in flight, we are enabled, owing to the courtesy of P. F. Collier & Son, to show our readers two photographs taken at long range of the aeroplane in flight around Kill Devil Hill. These photographs, while quite minute, nevertheless when magnified give some idea of the actual appearance of the machine in flight; but their greatest value lies in dispelling all doubt as to the ability of the Wright machine to fly and to make good its designers' claims. All those who witnessed the flights agree that the performance of the machine was marvelous, and that the speed attained with the small motor of 30 horse-power was remarkable. As already noted in our last issue, the speed in question appears to have been from 45 to 48 miles an hour, although the last flight was timed in 7 minutes and 40 seconds, during which the life savers claim that the machine traveled slightly over 8 miles. The distances are said to be fairly accurate, since they were gaged by the known space between telegraph poles and the number of poles in the course. The probability is, however, that the speed of the machine did not at any time exceed 48 miles an hour. In fact, the Wrights do not claim a speed of much over 40 miles. Still according to report, they state that before the flights witnessed by outsiders, they made three earlier flights of 18, 24, and 32 miles respectively. In their final flight they had intended to remain in the air an hour and twenty minutes, or a third longer than is required in the government test; but a false movement of one of the operating levers caused them to plunge downward. Not more than $50 worth of damage was done to the machine, and save for a few scratches the aviator was uninjured.

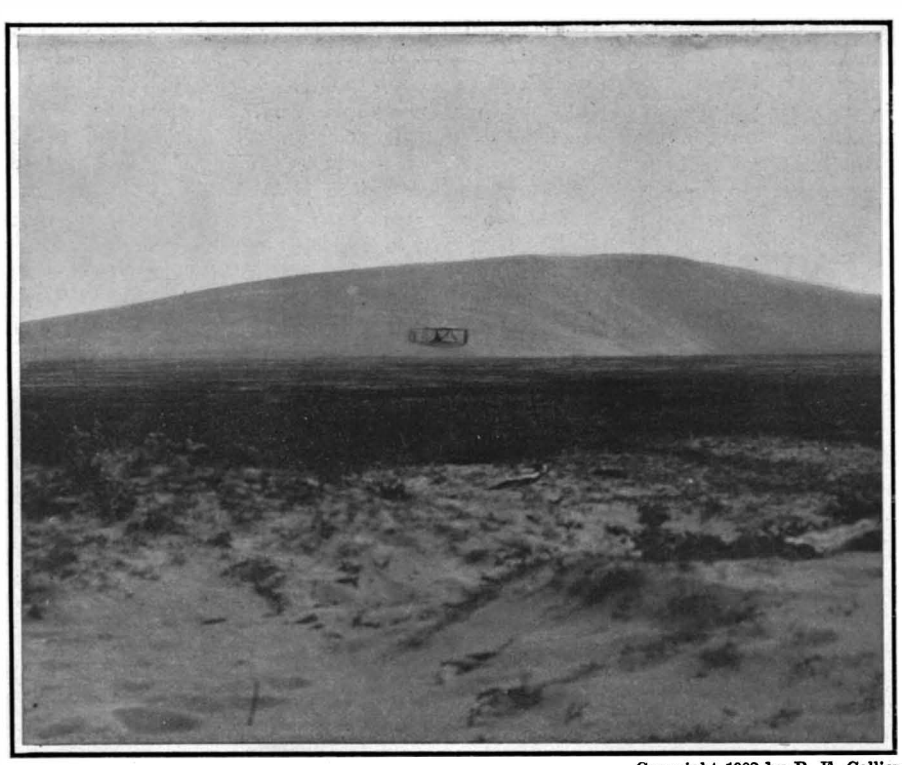
A close study of the photographs which we reproduce shows that the horizontal rudder in front of the machine is of the double- or triple-surface type. The vertical rudder also can be seen well out at the rear, as well as the two propellers, half of each of which is in sunlight, and the other half in shadow. The aviator is seen sitting in the middle of the lower plane, while there are several radiating tubes for the cooling water of the motor running vertically upward to the upper plane from the motor, which is located in a fore-and-aft direction in the center of the lower plane, and which drives each of the two propellers through chains. A second lever in front of the aviator operates the vertical rudder, and a third one twists the planes to aid in steering.

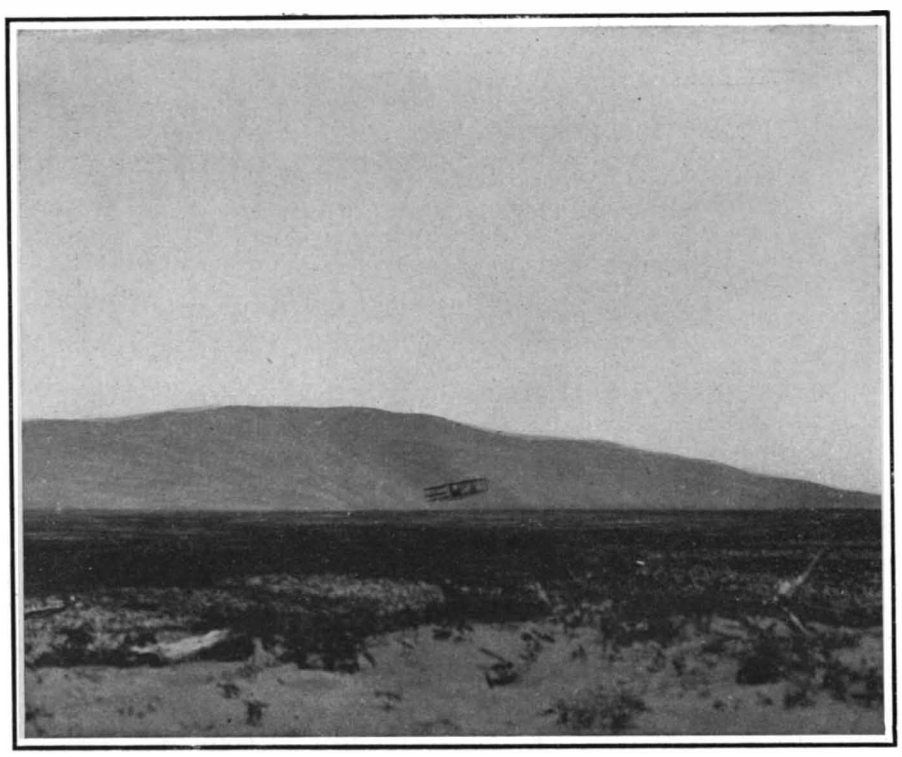
In the tests recently made, the Wright brothers were trying out their new form of steering and control by means of levers and with the operator in a sitting position. In their former flights in 1905, the operator lay prone, and the change to a sitting position necessitated a different method of control. The brothers are quite satisfied with the results they have obtained, and there is little doubt that more will be heard from them in the near future. Upon hearing of their flights, Henry Farman sent a challenge for them to come to France and fly in competition with him. The Wrights paid no attention to this challenge. Their confidence in their machine is such that they do not believe it necessary to make a public trial either here or abroad in order to interest the other governments, which may yet purchase machines from them. Since their trial flights in North Carolina have been witnessed by newspaper men, and photographs of these flights have been secured, there is no longer any doubt of the pre-eminence of America in aviation. We hope that before the end of the year we shall be able to arrange for a public contest near New York, in which all the prominent foreign and American aviators will compete, and endeavor to win for the first time the SCIENTIFIC AMERICAN trophy.

The imagination of the artist who drew this picture eighty years ago was prophetic and daring. He graphically foretold the modern department store, the elevator, the military airship, the pleasure and military automobile, and the heavier-than-air flying machine (drawn by birds). He did not hesitate to build a bridge between Calais and Dover or to draw vehicles along the ground with the aid of kites.

"THE MARCH OF INTELLECT." FROM A PRINT MADE IN 1828, PREDICTING MANY MODERN MECHANICAL ACHIEVEMENTS.

Casein cement consists of casein and tannate of lime. A solution of tannin is first prepared, either by dissolving tannin in water or boiling Chinese gall-nuts in water and straining the fluid. Clear lime is gradually added to this solution till precipitation ceases and red litmus paper, dipped in the fluid above, is colored blue. The fluid is then decanted and the precipitate dried. The dried product, designated chemically tannate of lime, is then mixed with casein and the mixture ground and sifted. The proportion in which the ingredients are mixed depends upon the purpose to which the mixture is to be applied; as a rule, 90 parts of casein and 10 of tannate of lime are taken. When required for use, a sufficient quantity of water is added to the cement. A tenacious binding material of the requisite consistency is thus obtained. When completely dry, the cement is very hard and tough, and absolutely insoluble in water, petroleum, or oil; hence it is admirably adapted for a large variety of purposes.





Copyright 1908 by P. F. Collier & Son. Photographs by J. H. Hare.

End view of aeroplane which is traveling to the left. The horizontal rudder can be seen in front and the vertical rudder behind. The inclined lines in front of latter are the propellers.

Three-quarter front view of aeroplane. The horizontal rudder is seen in front. The black spot in the center is the aviator and motor, and the dark line connecting the two surfaces, the radiator.

The Aeroplane Encircling Kill Devil Hill—the Gigantic Sand Dune at the Wrights' Experimental Grounds on the Coast of North Carolina.

FIRST PHOTOGRAPHS OF THE WRIGHT BROTHERS' AEROPLANE IN FLIGHT.

CHINESE PIGEON WHISTLES.

BY DR. BERTHOLD LAUFER, COLUMBIA UNIVERSITY.

Traditions imbibed in school, through education and by reading, are apt to sway our lives and our thoughts, and to influence strongly our judgment of other peoples. An almost fixed standard of attributes involuntarily arises in our minds when the names of French, Spaniards, Negroes, Indians, strike our ears, and it is often hard to see why such and such an adjective, expressing such and such a quality, became inevitably linked in our thoughts with the names of certain nations. Thus, we are wont to speak of the Chinese as a sober, practical, and prosaic people, and to view them throughout in that light. Immensely rational they are (this cannot be gainsaid), secular, and worldly-minded, bestowing all their efforts on useful temporal affairs; but nevertheless these people are by no means lacking in purely emotional matters of great attractiveness. It is needless to turn to their poetry and art, in which they are at their best, regarded from this viewpoint; even in affairs of minor importance their soul reveals to us traits of poetical quality of no small degree.

As early as the eleventh century one of their greatest poets sang:

"Upon the bridge the livelong day
I stand, and watch the goldfish play."

The domestication of the goldfish, the first species of which reached England only in 1691, and of the wonderful paradise-fish as well, is justly ascribed to the Chinese; and it is remarkable to notice that their attempts in this direction and the amazing results achieved were not prompted by any utilitarian views they had in mind, as neither fish is of any practical advantage. On the contrary, their skillful breeding, so eagerly pursued, is due solely and exclusively to the æsthetic tendency of the Chinese in their art of living, and to their highly cultivated sense of beauty, which delights in the bright coloration of the skin of these fishes, the graceful form of their bodies, and the restless motions of their long, flowing fins. This is the more worthy of note, as the only fish among us which has been placed within the range of domestication, the carp, is granted this privilege merely from its prosy connection with the kitchen.

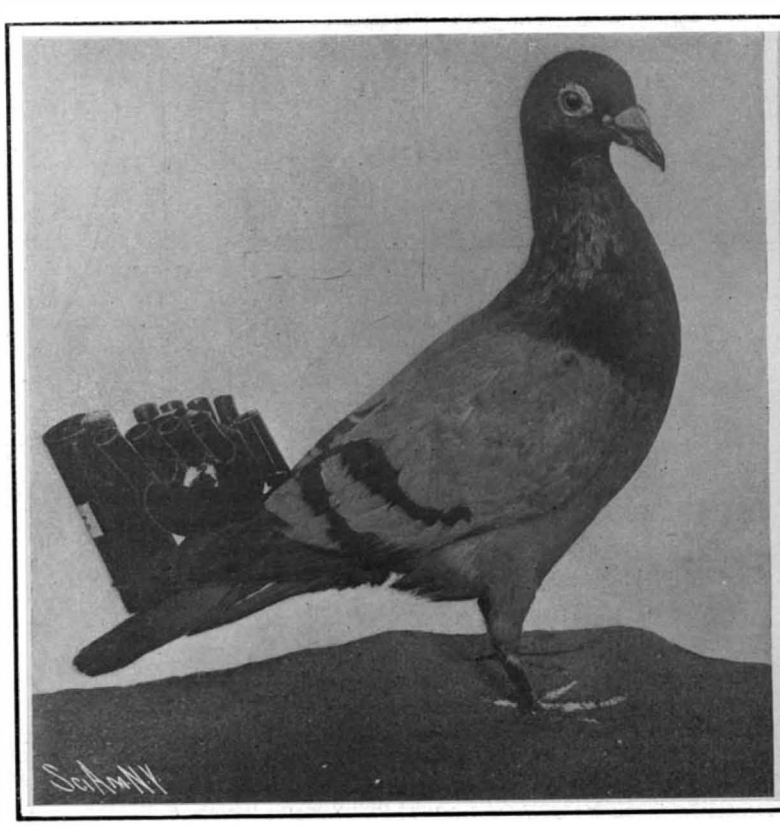
While the almost Darwinian experiments to which Chinese breeders have subjected the goldfish, and their unbounded admiration of this little creature in its hundred and one forms and variations, illustrate well the intimate relation of the people to the element water, their friendly associations with the world of birds are no less close and sympathetic. The lover of birds does not permanently confine his pet in its prison-cage, but he takes it out with him on his walks, carrying it on a stick, to which one of its feet is fastened by means of a thread long enough to allow it ample freedom of motion. Where the shade of some stately tree bids him welcome, he makes a halt, and permits the bird to perch and swing on a supple twig, watching it for hours.

One of the most curious expressions of emotional life is the application of whistles to a flock of pigeons. These whistles, very light, weighing hardly a few grammes, are attached to the tails of young pigeons soon after their birth, by means of fine copper wire, so that when the birds fly the wind blowing through the whistles sets them vibrating, and thus produces an open-air concert, for the instruments in one and the same flock are all tuned differently. On a serene day in Peking, where these instruments are manufactured with great cleverness and ingenuity, it is possible to enjoy this aerial music while sitting in one's room.

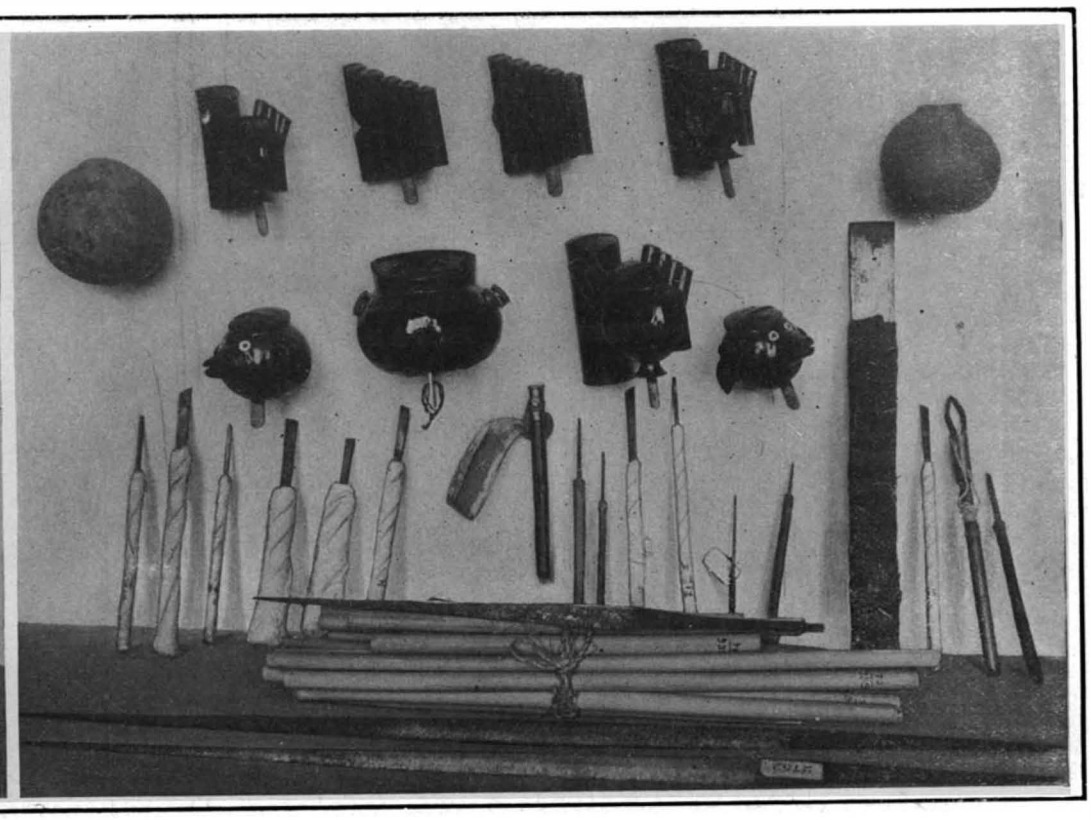
There are two distinct types of whistles—those consisting of bamboo tubes placed side by side, and a type based on the principle of tubes attached to a gourd body or wind-chest. They are lacquered in yellow, brown, red, and black, to protect the material from the destructive influences of the atmosphere. The tube whistles have either two, three, or five tubes. In some specimens the five tubes are made of ox-horn instead of bamboo. The gourd-whistles are furnished with a mouthpiece and small apertures to the number of two, three, six, ten, and even thirteen. Certain among them have, besides, a number of bamboo tubes, some on the principal mouthpiece, some arranged around it. These varieties are distinguished by different names. Thus, a whistle with one mouthpiece and ten tubes is called "the eleven-eyed one."

As to the materials and implements used in the manufacture of pigeon-whistles, there are small gourds that serve for the bodies; halves of large gourds (a particular species imported from Shantung to Peking for this industry), from which stoppers are made that fit into them; and four kinds of bamboo—cylindrical pieces of a large species that grows in the south, for making the mouthpieces of the large tubes; thin sticks for making those of the small ones; hard bamboo for the large tubes themselves, and a soft kind for the smaller ones. The separate pieces are fastened together by means of fish-glue, which is applied with an iron nail. A razor-like knife is used for splitting the bamboo sticks, and a chisel to break the harder pieces. For the general work a dozen spatulas are required, and awls are used for drilling the small mouthpieces. There is also a whetstone for grinding the implements, the same as is employed in other industries and by professional knife-grinders, and a saw with a slightly curved blade for cutting the gourds. The smallest whistles are of course most difficult to produce. One workman is said to be able to turn out about three specimens a day, which shows that the work requires some time and skill.

The explanation of the practice of this quaint custom which the Chinese offer is not very satisfactory. According to them, these whistles are intended to keep the flock together, and to protect the pigeons from attacks of birds of prey. There seems, however, little reason to believe that a hungry hawk could be induced by this innocent music to keep aloof from satisfying his appetite; and this doubtless savors of an after-thought which came up long after the introduction of this usage, through the attempt to give a rational and practical interpretation of something that has no rational origin whatever; for it is not the pigeon that profits from this practice, but merely the human ear, which feasts on the wind-blown tunes, and derives æsthetic pleasure from this music. And here, again, it seems to be a purely artistic and emotional tendency that has given rise to a unique industry and custom applied to nature-life.



A Pigeon With a Whistle Wired to Its Tail. The Whistles Look Clumsy But Are Very Light.



Pigeon Whistles, With the Gourds and Bamboos From Which They Are Made; and the Tools Used in Making Them.

CHINESE PIGEON WHISTLES.

A New Italian Method of Preserving Eggs.

Consul D. I. Murphy, of Bordeaux, forwards the following synopsis from a French journal on a new method of preserving eggs, which, he says, appears to have the double merit of cheapness and simplicity. The article was based upon the experiments of Doctor Campanini, as reported by him in a bulletin issued by the Italian minister of agriculture.

Dr. Campanini, after reviewing the various known means of preserving eggs—by salt water, lime water, silicate of potash, vaseline, and cold storage—described his experiments, which showed better results than all others.

His theory is that to preserve eggs some system must be adopted that will absolutely prevent the exchange between the air outside and that inside the egg—for it is this continual exchange that causes putrefaction.

Dr. Campanini selected perfectly fresh eggs and covered them with lard, so as to effectually stop up all the pores. The shells were thus rendered impermeable, the exchange of air was prevented and, the obstruction of the pores not permitting the evaporation of the water, there was no loss of weight. The whites and yellows of the eggs retained their color perfectly and the taste was not modified in the slightest degree. When properly coated with lard—not too thickly—the eggs are put in baskets or boxes upon a bed of tow or fine odorless shavings and so arranged that there will be no point of contact between them—otherwise a mold will develop and putrefaction result. The packing room should be perfectly dry, the question of temperature not being important. By his process Dr. Campanini kept a quantity of eggs for a whole year —through a very hot summer and a very cold winter —and they were perfectly preserved. He says that 4 cents' worth of lard suffices to coat 100 eggs, and that anyone could easily prepare that number of eggs in one hour's time.

Wasting Water Assets.

California has learned, says the California Cultivator, not only that the ground may become waterlogged by over-irrigation, but that ill-considered drainage and the inconsiderate use of water from wells may so lower the underground water-plane as to threaten the reversion of large areas to unproductiveness.

The Geological Survey has demonstrated that all the subterranean waters of 775 square miles in southern California are connected, and that every well taps a common supply; and on this the water-plane, which was twenty-three feet below the surface of the soil in 1898, is now fifty feet below.

People can live beyond their means in respect to water, as well as timber, oil, natural gas, fish, and game.

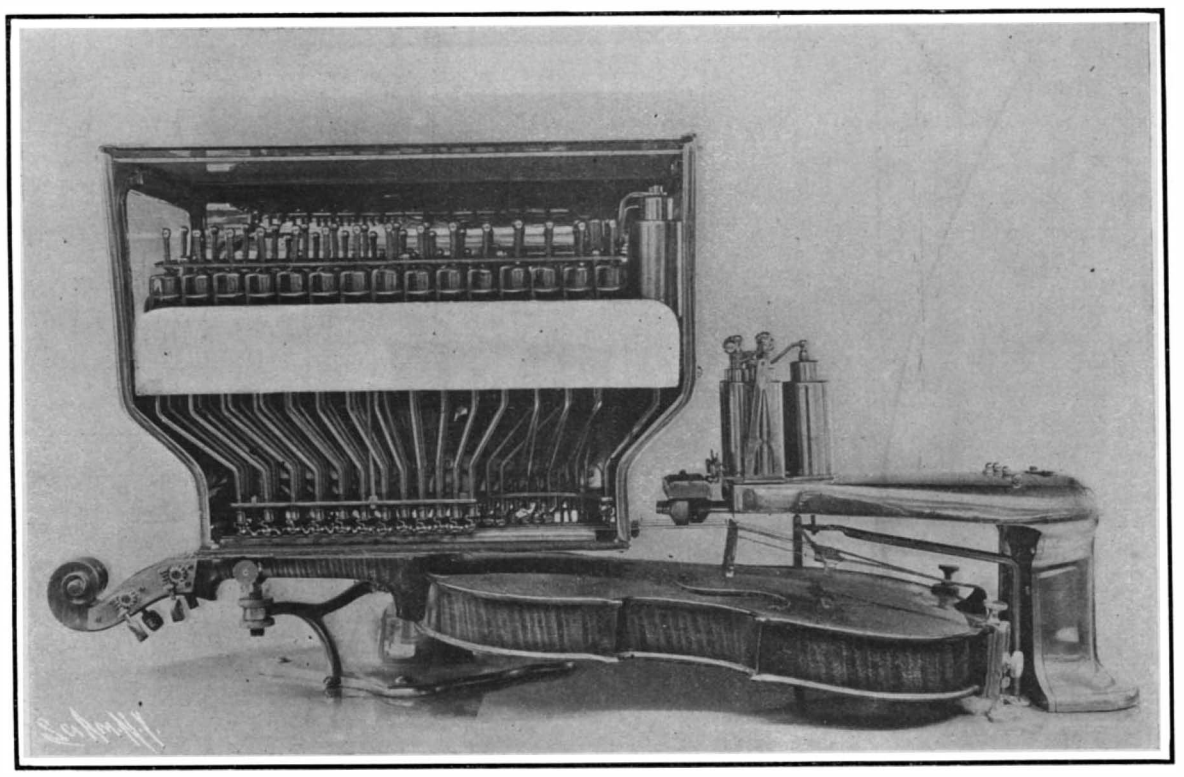
The output of copper in the Ural district in 1906 amounted to 4174 tons, as compared with 3,610 tons in the preceding year, thus showing an increase of 564 tons. These figures cannot be considered as satisfactory from the Russian point of view, taking into consideration the high prices which prevailed last year for copper. Moreover, on comparing the total output of copper in 1906 with that of the years 1904, 1903, and 1902, a decrease in the production is noticeable.

A NEW AUTOMATIC VIOLIN PLAYER.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

One of the most novel and ingenious automatic musical instruments devised within recent years is now on exhibition in England. This is the Mills automatic violin player, which, as may be seen from the accompanying illustration, is a delicately constructed and remarkably designed automatic violin, in which the fingers of the player are supplanted by mechanical agency. The instrument is the result of several years' experiment and scientific research, and although played by electro-mechanical agency, the rendering of the music is so delicate that it is difficult to distinguish it from that of a master hand. The sweetness is remarkable, as are also the harmony and volume of tone.

The instrument, as may be seen from the accompanying illustration, comprises the ordinary type of violin, complete in every detail, with the usual strings and facilities for tuning. The instrument is held firmly at the neck, to secure the same position as if held under the chin, while the opposite end is held by a solid support. Above the strings is mounted an intricate and elaborate mechanism, with lever rods, which act as fingers, and by depression upon the strings in the correct positions give the required notes. The bow, or rather series of bows, since there are many in order to secure full chord effects, is represented by a number of revolving disks, which in their rotating passage strike the strings as they are depressed upon them according to requirements, and in conjunction with the mechanical fingers sound the required notes. There is a complete absence of harshness, such as might naturally be expected in a mechanically-operated instrument, while the diminuendo and crescendo effects are faithfully reproduced. The mechanism is operated by a small but powerful electric motor driven by batteries; the control is effected by means of an ingenious arrangement of electro-magnets. The whole of the mechanism is in motion at one and the same time, each composite part performing its allotted function in accordance with the musical score, at the correct moment.



AN AUTOMATIC MACHINE FOR PLAYING THE VIOLIN

Every person familiar with the instrument is fully acquainted with the difficulties attending its mastery, and the many musical impressions peculiar to violin playing. Yet all such, as staccato, legato, pizzicato, arpeggio, shake, trill, thirds, fourths, octaves, tenths, portamento, are marvelously produced. It renders with complete accuracy and striking execution the most difficult classical passages as readily as the more simple popular airs.

Moreover, it exceeds the capabilities of the human player. Duets and even quartets are given with as much facility and delicacy as solos, it merely being a matter of coupling up the mechanical actions. In this manner a single instrument can render the full effects of a stringed orchestra, while moreover, in order to complete its possibilities, it will play its own accompaniments to solos, and very often the four strings are brought into requisition at the same time.

The automatic player has been investigated by many of the leading violinists, who have listened to its renditions of the most intricate and difficult music, and have pronounced them to be musically perfect, while time, melody, harmony, and expression are produced with such distinctive skill as to testify to the precision of the mechanical arrangements. The invention has aroused the greatest interest in England and Europe, since it is to the violin what the pianola is to the piano, and demonstrates to a striking extent the musical qualities of the instrument when developed to its fullest extremity.

AN ORAL SYSTEM OF TELEGRAPHY.

BY GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

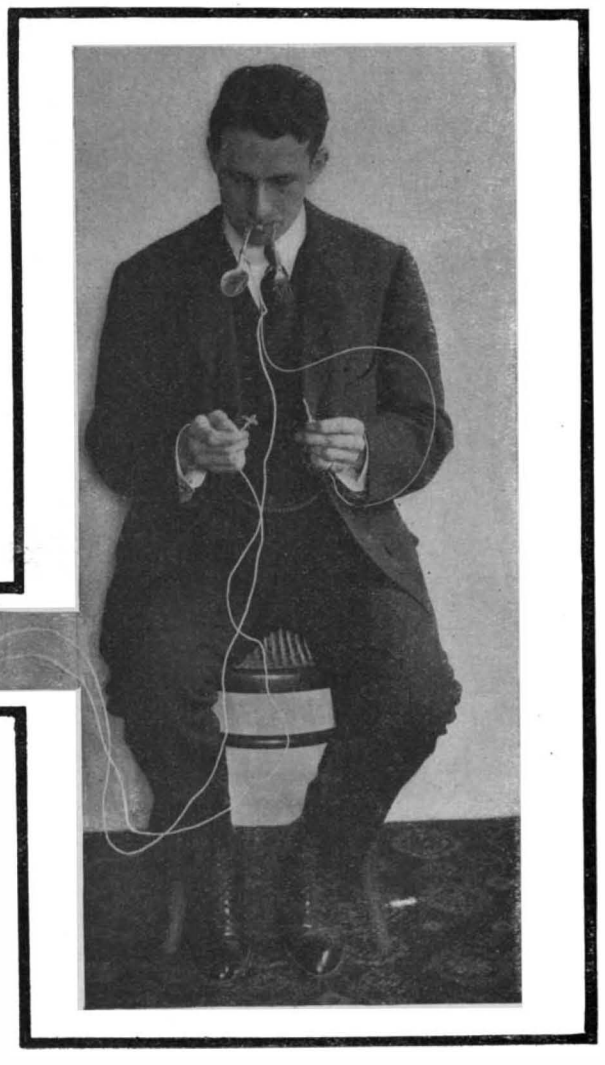
We are accustomed to think of the tongue as a transmitting instrument, but it serves very well as a receiver in the novel system of oral communication described below. With the exception of the wire, all that is needed for this oral telegraph may be had at the dinner table. The battery, two senders, and two receivers are made up, ready for use, in less than one minute. The apparatus works well, and does not get out of order. After dinner it will afford a pleasant pastime, and may prove useful to those teachers who have to teach with few or no apparatus.

Lay two parallel wires from one room to another, avoiding contact between them. At each end of the telegraph line, place an operator holding two spoons or forks in his mouth. One of these culinary implements must be made of silver, the other of aluminium. A silver quarter may conveniently be used instead of the silver utensils, and any aluminium object may be substituted for the other spoon or fork. A wire which bears a silver object at one end must have aluminium at the other end, and *vice versa*. Operators should keep the silver well in the mouth on one side, and the aluminium in full contact with the fore end of the tongue on the other side of the mouth. No contact should take place between aluminium and silver.

The operator who wishes to send a message breaks one of the two wires, and keeps both ends in his hands. To send a dot of the Morse alphabet, he brings into contact, during a short time, both ends of the broken wire. A long contact is a dash. At the other end of the line, dots and dashes are perceived as short or long spells of a strong, pungent taste, which ceases at once when the current is interrupted. There is no uncertainty in deciphering the message; on the contrary, most operators will say that, so far as their own taste is concerned, they would rather have a weaker current. After sending his message, the operator twists the ends of the broken wire together and waits for the answer.

The current is the result of the chemical action of alkaline saliva over the aluminium. The two cells are connected in series, and the E.M.F. is twice greater than in the case of a single cell. So is the internal resistance, but that of the wire is not, and the current strength is therefore somewhat increased.

Reading a Telegraphic Message by Taste.



Sending a Telegram With Current Generated in the Mouth.

AN ORAL SYSTEM OF TELEGRAPHY.

A New Chinese Steamship Line.

According to the Board of Trade Journal, the Registrar of Imports and Exports at Singapore (Mr. A. Stuart) reports that a new steamship company, with a capital of 3,000,000 ticals (about $1,125,000) is being organized by Chinese and Siamese merchants with the object of entering the carrying trade between Bangkok, Singapore and Hong Kong in opposition to the North German Lloyd, who have recently come to an agreement with the Japanese owners of the vessels on the Bangkok, Hong Kong and Swatow service. As the promoters include several large rice merchants who have usually done a chartering business on their own account, the company's success, says Mr. Stuart, seems to be assured. Meantime six vessels will be chartered and new boats built in England or Japan.

Europe has demonstrated that a country can be prosperous and develop on a very small amount of lumber. Practically speaking, there is not a wooden shingle in the whole of Europe, while frame houses are rare. Lumber yards in some countries of Europe hardly exist.

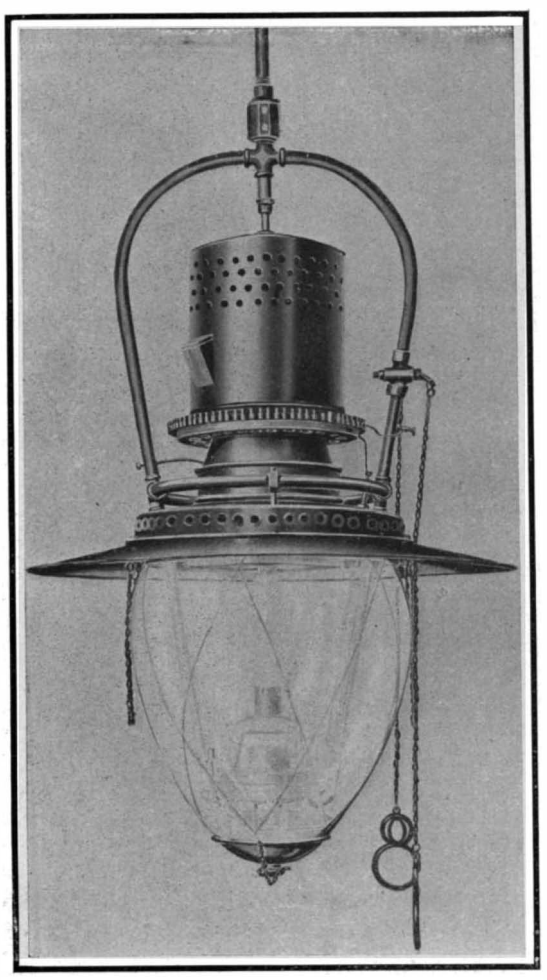
INCANDESCENT GAS LAMP WITH SELF-GENERATED FORCED DRAFT.

The light of a gas flame is due to imperfect combustion. The heat of the flame liberates some of the carbon in the gas, and the particles of carbon are heated to incandescence by the combustion of the rest of the gas. If air is mixed with the gas, as in a Bunsen burner, a more perfect combustion takes place and a greater heat is generated, but the flame loses its luminosity to a corresponding degree.

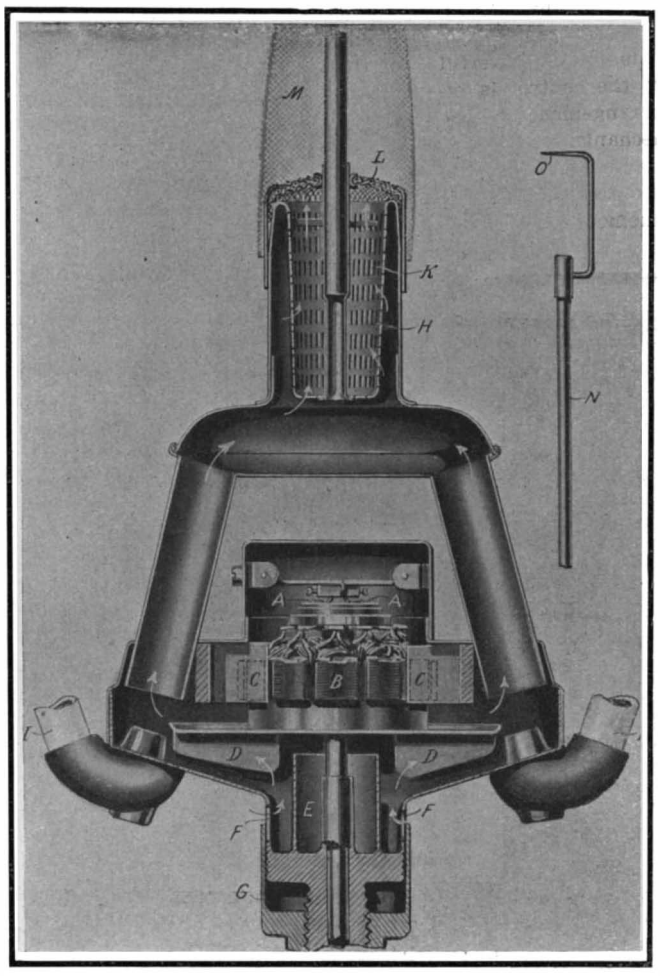
Twenty-three years ago it occurred to Baron Carl Auer von Welsbach that instead of depending upon unconsumed carbon for light, better results could be obtained by generating all the heat possible in the gas flame, and using this heat to render incandescent some mineral substance that would not be consumed by the flame. Thus, the Welsbach mantle was evolved.

Unfortunately, the ordinary Bunsen burner does not furnish sufficient air to produce a perfect combustion of the gas. The air is drawn up into the burner mainly by the injector action of the gas. The chimney of the lamp also produces a draft, due to thermal expansion of the air about the mantle, but most of this air plays upon the outside of the mantle instead of being intimately mixed with the gas before burning. It is stated that to obtain the highest temperature of flame, the mixture should consist of one part gas and five to six parts of air, whereas the ordinary burner furnishes less than three parts air to one of gas. A larger volume of air is sometimes furnished by using a forced draft, but heretofore this has entailed the use of special apparatus to compress the air which, aside from encumbering the lamp, increases the cost of maintenance.

Recently a German inventor, Herr Paul Lucas, of Berlin, has devised a new type of gas lamp, which operates automatically to supply the requisite forced draft. The lamp gives a very brilliant light. A small electric motor at the bottom of the lamp drives a fan, which draws the air into the mixing chamber of the lamp. No expense is involved in driving this motor, for by an ingenious arrangement the lamp is made to generate its own current from the excess heat, which goes up the chimney. The heat is directly converted into electricity by means of a thermopile placed in the upper part of the lamp. The thermopile is shown in one of our engravings. It consists of a series of electropositive and electronegative metal strips, joined in pairs and radially disposed about a common center. The lamp heats the inner ends of the couples to a high degree of temperature, while the opposite ends project out of the lamp, and are kept comparatively cool by radiation. There are about seventy couples in the thermopile we illustrate, and the combined current produced by the difference of temperature in each couple is ample to operate the electric fan of the lamp at a speed of 2,000 revolutions per minute. Ordinarily thermo-electric couples are made of bismuth and antimony, or sometimes of tin and an alloy of antimony and zinc. But in this lamp, where the elements are subjected to a high temperature, it is found necessary to use such heat-resisting metals as copper, aluminium, and nickel. This form of electrical generator is admirably suited to the lamp, as it contains no moving parts, and hence is not liable to require any repairs or other attention. Not only does it make use of the waste heat of the lamp, but it cools the lamp as well; thus at the same time overcoming and putting to service an objectionable feature of the ordinary incandescent gas lamp.



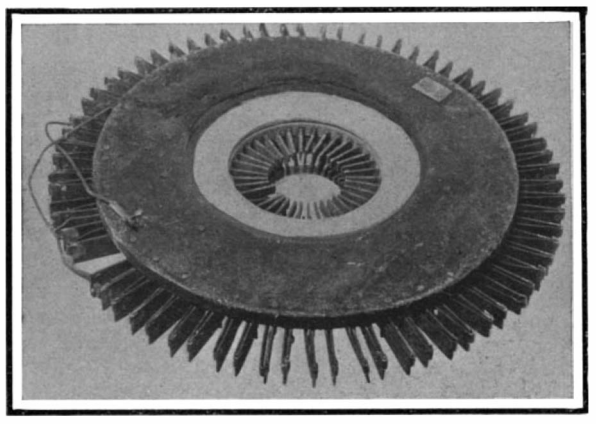
The Lamp Gives a Light of 1,300 C. P. and Burns 33 Cubic Feet of Gas.



Section Showing the Electric Fan Which Produces the Forced Draft.

AN INCANDESCENT GAS LAMP WITH SELF-GENERATED FORCED DRAFT.

One of our illustrations shows a section of the lower part of the lamp, revealing the motor and fan and the mixing chamber. The current generated by the thermopile is conducted by means of brushes *A* to the armature *B* of the motor. Permanent magnets *C* are used for the field magnets of the motor. Beneath the armature proper is a plate, on which the fan blades *D* are formed. The fan is thus an integral part of the armature, and turns with the motor. The armature is mounted on a spindle, which rotates in a socket in the lamp frame, and is kept well lubricated by means of the oil cup *E*. As the motor rotates, and the fan serves to draw air through openings *F* in the lower part of the casing. A sleeve *G* is mounted in such manner that it may be adjusted to open or close the openings, and thus regulate the volume of air sucked in by the fan. The supply of gas is fed into the mixing chamber *H*, through the tubes *I*, and the air drawn in by the fan is also forced with the gas into this chamber. Projecting into the mixing chamber is a perforated cup *K*, through which the



The Thermopile Which Generates the Current for the Electric Fan.

combined air and gas must pass before issuing out of the screened top *L* of the burner. In passing through the perforated cup the air and gas are intimately mixed, and thus produce an ideal combustion, which heats the mantle *M* to a far more brilliant incandescence than is obtained with the ordinary burner.

The lamp here illustrated burns 33 cubic feet of gas per hour and to enable one to adjust the gas supply properly a small regulator *N* is provided. When installing the lamp this regulator is attached to one of the gas supply pipes *I*, and the gas issuing from the tube of the regulator is ignited. The gas cock is then adjusted until the flame of the regulator just reaches the gage wire *O*, which indicates that requisite amount of gas is supplied to the lamp. The gas cock may then be locked at this adjustment because further regulation will not be required. The lamp is adapted particularly for use in large stores and for street lights. It measures three feet over all, and has a reflector two feet in diameter. It gives a light of from 1,250 to 1,300 candle-power, and as it consumes but 33 cubic feet per hour, its cost per hour is but little more than three cents. The lamp is being exhibited by Mr. F. A. Imandt of 27 West Thirty-third Street, New York, N. Y.

It is estimated that South America furnishes about 63 per cent of the world's supply of India rubber.

Successful Cultivation of Mexican Pearls Carried On in Lower California.

Consul W. D. Shaughnessy, of Aguascalientes, transmits an article to the Department of Commerce and Labor from the Mexican Herald, of February 16, 1908, wherein it is claimed that the honor of being first to discover and put into successful operation the secret of cultivating pearls belongs to a Mexican company. The following paragraphs are taken from this article:

"Under the old system the pearl industry was an uncertain one. Bushels of shells might yield but a few gems or possibly none at all. But this company, which is working under a concession from the Mexican government, has taken up the cultivation of pearls as a practical industry, and is now operating the largest pearl farm in the world, employing in the harvesting season more than 1,000 people. They are operating in the Gulf of Lower California. The present markets for the company's products are Paris, London, and Berlin, and Hamburg and Bremen for the mother of pearl, which is exported in large quantities.

"Two years are required for the growth of an ordinary shell, which forms slowly in layers, like an onion. After two years the shell loses its gem, and, unless opened at the proper time, there is nothing of value within. Mr. Vives, who spent twenty-five years in studying and experimenting, discovered this fact, and thereupon he devised the system whereby the shells are cultivated until the proper time and then opened.

"In the first place, the shells are gathered in the season when the eggs are being deposited. These eggs are carefully placed in little artificial channels like the natural bottom of the sea, care being taken in these channels to protect the little animals from their natural enemies. At the proper stage they are transplanted into deeper water, where larger boxes continue to protect them. The stock is also inspected and the dead ones removed and replaced by live shells. In the deeper channels the shells are left to develop, and at the end of two years the harvest is ready. In the deep-water cages, where the pearls develop, the divers can descend without risk.

"Three distinct kinds of pearls are produced in the California Gulf, the most valuable, black pearls, ranging close to $300 per carat gold. The next in point of value are the white pearls, about $250 a carat, the price varying with the size and perfection of the gem. The yellowish pearl, although ranking third in value, is, as a rule, first in favor among the feminine admirers because of the brilliancy of the gems. These prices are for the rarest and most perfect pearls."

Vice-Consul Ernest Santi, of Milan, sends a report on the correct way to introduce American soldering preparations in Italy. He states: Many different mixtures are used in Italy at the present time for soldering preparations, but they are nearly all primitive. There are some patented articles on the market, but they do not seem promising, as the Italian user in general would rather use a mixture containing muriatic acid, which he has always used, than risk novelties. The success of the American article depends on its price and its results, and to exploit it correctly on the Italian market the American firms must send a full line of samples to each user with directions for use, together with prices and terms of sale. Italians should be induced to try the article at the expense of the American firm, and instructions for use should also be given.

The Italian consumption of these goods is not great, but it is large enough to be worth while for some American firm to establish a good business in Italy after the various consumers have tried the soldering preparations and they have proven satisfactory in every way.

Solder wax in sticks pays $1.93 duty per 220 pounds entering Italy, and wrappers or cardboard boxes containing them pay separately $13.51 per 220 pounds.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT-CLOSING DEVICE.—IDA J. CALHOUN, Tampa, Fla. The purpose in this case is to provide novel details of construction for a device which will enable the quick and convenient closing and separation of opposing edges on a body, or a waist of a woman's dress, or any garment that requires a detachable connection of its lapped edges when donned.

SKIRT.—B. COHEN and W. EPSTEIN, New York, N. Y. In this patent the invention has reference to wearing apparel, and its object is to provide a new and improved skirt arranged to properly and accurately fit women having different sized waists, at the same time insuring the proper hang of the garment.

SKIRT.—W. EPSTEIN and S. EPSTEIN, New York, N. Y. The object of the improvement is to provide a skirt or petticoat, provided with a waistband having an expansible and contractible portion, arranged in such manner that the waistband readily fits different sized waists, and at the same time insures a proper hang of the garment.

Electrical Devices.

ELECTRICAL CUT-OUT.—P. T. MCNALLY, Mandan, N. D. The device is for use in operating at a distance electrical switches in branch lines of electric lamps whereby the current may be cut-in or cut-out in said branch lines either from the power house or any remote station, thus controlling the current on the branch lines without shutting off the current in the main line leads.

Of Interest to Farmers.

THRESHING-MACHINE.—T. S. HAYNES, Bay City, Texas. The machine is especially adapted for the cutting and threshing of small grain, as rice and the like, and is so constructed as to perform its functions satisfactorily when the grain is wet as well as when dry, as also to work well in marshy and water-covered fields, which is essential to a practical rice threshing machine.

STALK-CUTTING ATTACHMENT FOR VEHICLES.—R. B. HUMAN, Chickasha, Oklahoma. The purpose of the inventor is to provide an attachment complete in itself, and which can be applied to the forward or rear axles of an ordinary farm wagon, or similar vehicle, and to provide means for raising and lowering the cutter, and means for counteracting the rebound of the cutter when in use, thus preventing severe injury to the blades of the cutter should it meet with an obstruction in its path.

Of General Interest.

CUSPIDOR, DRAINAGE-BOWL, OR THE LIKE.—A. R. CANDY, Urbana, Ill. The invention is an improvement in cuspidors, drainage bowls, or other like devices of the type that occupy a fixed position in the floor and are connected with a sewer or other suitable drainage or discharge into the open, especially designed for cars, hotels, and public places.

TRESTLE.—M. WHITE, Portsmouth, Ohio. The invention relates to improvements in trestles such as are used by plasterers, carpenters, and other artisans, and has for its object to provide a trestle that can be made at a small cost and one which can be quickly and easily set up, moved, and taken down.

NAME-HOLDER FOR UMBRELLAS OR OTHER PORTABLE ARTICLES.—W. N. REYNOLDS, Litchfield, Conn. One purpose of the invention is to provide a name plate adapted for attachment to an umbrella handle or stick, a cane or other portable object, and to so construct the device that a card bearing the name and address can be readily introduced into the device in such manner that it will remain until purposely removed, and when so desired the card can be quickly released.

GAS ANALYSIS APPARATUS.—J. F. SIMMANCE, 17 Ravenscourt Park, Chiswick, London, S.W., and J. ABADY, Fountain Court, Temple, London, E. C., England. According to the present invention the gas or gaseous mixture to be tested (whatever the pressure at which it reaches the apparatus) is always and automatically brought to the same pressure, so that a series of volumetric tests, if performed under identical conditions as regards temperature, will yield results having a uniform degree of accuracy and value.

AMALGAMATOR.—F. B. SANFORD, North Yakima, Wash. In this instance the invention has for its primary object the provision of means for treating auriferous wash by gravity unaided by mechanical force, and without reducing the ores to a finely pulverized pulp, as is necessary with the devices now in common use.

CLOTHES-HOLDER.—S. S. SMITH, New York, N. Y. The more particular intention in this improvement is to provide a device suitable for supporting garments, bed clothes, and other articles made of cloth, so as to facilitate the bleaching of such articles by aid of the dew and grass, yet without allowing the articles to rest directly upon the ground.

TYPE-CASE.—J. G. GALLEMORE, Washington, Mo. The object of this inventor primarily is the provision of a case in which no opportunity is presented for the type to work or slide under the partitions from one compartment of the case to another, or to be in any wise caught or lodged under the partitions. The bottom of each type receptacle is preferably perforated for the purpose of permitting dust to sift therethrough and thus prevent its accumulation in the several type compartments.

WELL-BUCKET DUMP.—H. R. ANDERSON, Gainesboro, Tenn. Broadly stated the invention consists of a hollow stock or tubing, with its interior providing passage-way for ordinary form of bucket, having a gravity, or other suitable form of downwardly seating discharge valve in its bottom, means whereby to lower the bucket down the well, to be filled with water, and also adapted for use in elevating the bucket of water and whereby to draw it upward on the stock, and when so elevated, permitting closure of the passage-way through the stock, by adjustment of a slide-valve.

Hardware.

WRENCH.—H. N. ROTHWEILER, Seattle, Wash. The object of the inventor is to provide a tool, which shall not only be novel in its general makeup but improved over similar wrenches as hitherto constructed, and at the same time render the parts adapted not only to be cheaply constructed, but with the wearing parts interchangeable, whereby a worn part may be readily replaced.

MOWER.—T. M. CREPAR and ROSETTA W. CREPAR, Fargo, N. D. The object here is to provide a mower for the cutting of lawns, grass-plots, and the like, and having a clipper arranged to be operated by the movement of the mower itself. Also to provide a mower having an automatically operated clipper which can be adjusted to cut to any degree of closeness, and which is mounted upon a wheeled frame and co-operates with a brush similarly operated by the mower, for advancing the severed grass to a receptacle.

DEVICE FOR DRESSING SAWS.—T. W. ROACH, Lyman, Wash. The purpose of the invention is to improve upon the construction for which Letters Patent were formerly granted to Mr. Roach, to the extent that the device is rendered more simple and will be more accurate under long usage, since the adjusting device may be used indefinitely without loss of action.

Heating and Lighting.

LAMP.—W. S. RYAN, Viola, Ill. It is especially designed to have the oil tank in the form of a street lamp post, which connects with a small feed tank for supplying the lamp for a predetermined length of time. By this construction the feed tank can be filled from the reservoir to feed the lamp for any period, and when the fuel is consumed in the feed tank the lamp will automatically go out.

Household Utilities.

DEVICE FOR OPERATING WINDOW-BLINDS.—D. F. LONERGAN, Morristown, N. J. The object of the present invention is to simplify the construction and provide in connection with the principal bearing thereof, a stop which is adjustable relative to the shutter, whereby the latter may be prevented from swinging beyond the desired point in its opening movement. It is an improvement in shutter closers and openers of the character described in Letters Patent formerly granted to Mr. Lonergan.

WINDOW-CLEANER. — O. CAESAR, New York, N. Y. In the present patent the object of the inventor is to provide a new and improved window cleaner, arranged to permit convenient and thorough cleaning of the window sash, both on the inside and outside, and without the slightest danger to the operator.

TRAP.—P. AYRES, Ocean Side, N. Y. The object in this invention is to provide a trap, arranged to permit the plumber to quickly connect a sink, basin, or like fixture with the soil or waste pipe, and to make a perfect joint with the soil or waste pipe without requiring the tedious and expensive work of wiping a joint.

Machines and Mechanical Devices.

STEERING-GEAR.—C. J. SCHOENING, Honolulu, Hawaii. The object here is to provide a gear, more especially designed for use on automobiles, motor boats, air ships, and other vehicles, and arranged to bring the steering wheel into position for convenient manipulation by the driver of the motor vehicle and to allow of adjusting the steering column, to permit convenient access to or egress from the driver's seat.

MEAT-CUTTING MACHINE.—E. W. RUSK, Callaway, Neb. In the slicing of meats for retail, the butcher uses his knife to slice the flesh until the bone is reached and then discarding the knife takes up the saw and saws through and then, resuming the knife, proceeds to sever the still connecting flesh. Rotary machines have been devised, but for various reasons the knife and saw are still used. This invention provides a practical machine for doing the work without constant change of implements.

SPEED-INDICATOR.—J. G. FIELD, Thompson, Iowa. The invention has in view the provision of suitable mechanical means for indicating the relationship between the speed of the device of which the speed is to be determined, and the speed of means, as a motor, moving at a predetermined velocity.

SAMPLE-TAKING MACHINE.—A. FENSTERMAKER, Colton, Cal. In this patent the invention relates to mechanism for taking samples from time to time, of a manufactured material or product, and is especially useful for the purpose suggested in connection with the manufacture of granular or pulverized material such as powder or flour. It may be used to effect the taking of samples through a number of spouts, carrying different materials, by simply duplicating the downwardly extending sample chute and the operating lever connections controlling the valve thereof.

MACHINE FOR MOLDING PLASTIC MATERIAL.—J. L. CAMPBELL, Roebuck street, West Adelaide, South Australia, Australia. Mr. Campbell's invention is an improved machine for use in molding plastic material into lengths of any desired section, and it has been designed especially for manufacturing lengths of core as used in foundry work and lengths of clay adapted to be cut into bricks.

VARIABLE FLOAT-SHAFT BEARING FOR COTTON-SEED-LINTING MACHINES.—J. L. ROSSON, Athens, Texas. The inventor provides a variable shaft bearing for use in regulating and maintaining the density of the roll of cotton seed carried by the float shaft of the linting machine. The machine is provided with a float drive shaft, the latter being provided with a fluted drum for drifting the cotton seed against the saws of the saw shaft.

AUTOMATIC ASSEMBLER.—W. L. AINSLIE, Jacksonville, Fla. The machine makes fruit packages, such as crates and the like. The assembler is designed as a feeder for the package-making machine and is arranged to automatically assemble the several members of the side or top in such manner that the assembled members can be readily fastened together in the machine by the use of nails, staples, rivets, or like fastening devices.

WORK-BOX FOR SEWING-MACHINE TABLES.—ANNIE H. DANIEL and R. P. DANIEL, San Antonio, Tex. The invention relates to cabinets of the drop type, and the aim is to provide a work box for removable attachment to a sewing machine table, and arranged to require no remodeling of the machine cabinet to allow of readily placing it in position or removing it therefrom without injury to the cabinet, to blend harmoniously with the other wood-work when in use, and to be wholly inconspicuous when closed.

STEAMING APPARATUS.—J. HALL, Fresno, Cal. The object of this inventor is to provide a steaming apparatus of simple, strong, and durable construction in which the fruit is subjected to the action of dry steam for a suitable period, and from which the same is subsequently discharged in a proper condition for removing the seeds or pits.

Prime Movers and Their Accessories.

PRESSURE-REGULATING VALVE. — S. YBARRA, St. Louis, Mo. Fluid admitted to the valve through an inlet, passes through a passage into a recess, thus acting to force the plunger upward. Since the passage connecting the oppositely arranged recesses is restricted only a certain amount of motive fluid may pass, and excess of pressure acts upon the bottom of the plunger to move it upward against resistance of the spring. Means regulate the pressure through the passage between the recesses. Pressure remaining constant, the plunger is not acted upon, a spring retaining it in lowermost position. On material increase of pressure the plunger is moved upward to partially cut off inlet and outlet, thus reducing pressure in the casing.

ROTARY ENGINE.—G. H. TUTTLE and E. A. KENT, Atlanta, Ga. The object here is to produce a prime mover economical in steam consumption and efficient in operation. More specifically, the invention concerns itself with an abutment which projects into the piston chamber and which is automatically controlled to allow the piston head to pass.

ROTARY MOTOR.—A. SAUER, Pittsburg, Pa. This invention relates to improvements on that class of motors or turbines in which a rotary piston is driven by the impact, and reactionary force of steam or other motive fluid. It is more particularly an improvement upon a motor for which Mr. Sauer formerly received Letters Patent. The inventor has put into successful use several improved features of the construction and obtained superior results.

Railways and Their Accessories.

SWITCH MECHANISM.—C. F. GAY, Spokane, Wash. The invention refers to improvements in mechanism for operating switch tongues of railways, and the object is to provide a mechanism which shall be simple in construction and that may be moved from inoperative position to a position for moving the switch tongue into its positions.

STATION-INDICATOR.—C. F. BILLINGS, Zion City, Ill. One purpose here is to provide an indicator so constructed that the upper and lower rollers carrying the apron upon which the stations are indicated are operated by independent mechanisms, so that no matter which roller is operated a name will appear at the display opening in the indicator at each complete operation of the mechanism brought into action.

Pertaining to Vehicles.

VEHICLE-BRAKE. — H. M. VANDERBILT, Suffern, N. Y. The brake is designed for use primarily as an emergency braking means for motor vehicles, especially avoiding undue wear of the tires. A clamping shoe is attached to a flexible band or other connection adapted to be drawn under the wheel of the vehicle when the shoe is thrown into engagement with the tire. Means are provided to automatically draw the band and shoe to normal or inoperative position after the braking action has been accomplished and the vehicle backed to release them.

TRACE-SECURING MEANS FOR SWINGLETREES.—T. MORCOM, Graham, N. C. The object in this case is to provide details of construction for a device which will in a convenient manner secure traces on the ends of a swingletree, and permit a release of the traces quickly, their accidental displacement being impossible unless the parts are broken.

ATTACHMENT FOR DIRT PUSH-CARS.—J. W. GRUBBS, Shenandoah, Va. The patentee secures a frame to a car body in mounts at each side of inclined adjustable deflecting boards on which the dirt is dumped from the hoppers mounted on the car, the arrangement being such that the deflecting boards can be adjusted so that the dirt will be carried beyond the track ballasting.

Designs.

DESIGN FOR A COVERED DISH.—A. PAROUTAUD, New York, N. Y. The design includes a dish and a cover for the same capped with an ornamental lifter in the form of an olive leaf wreath. The dish is oblong, the whole very gracefully balanced on a neatly curving base configuration.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10779) G. A. D. asks: Will you kindly mail me the answer to the following question, which is a branch of electro-plating? I wish to know how the color termed "verdigreen" is produced on the surface of brass, or, in other words, how I am to produce a color which looks as though brass has been buried and verdigris has formed thickly on the same. I have a number of brass wall plates on which are set electric push buttons. The plates are 6 inches by 10 inches. A. A green coating is obtained upon brass by the use of verdigris, which is called in chemistry acetate of copper, or by carbonate of copper, or by a mixture of the two in the tint desired. This is mixed with a light-colored varnish and applied to the article with a brush, and the high parts are immediately wiped off with a rag wet with the liquid in which the varnish was dissolved. This may be alcohol. A smooth coating should be left. A coating of clear lacquer is put over the whole when the varnish is dry. There is no need of electricity in doing this. It is a process in lacquering. It is more fully described in Van Horne's "Modern Electroplating," which we send for $1.

(10780) H. F. W. asks: In thinking of the power of gravitation and the resultant weight of objects and incidentally of the power of magnetism, electricity, etc., the query arose in my mind: "How is weight affected by distance from the earth?" I wondered if this had ever been experimented with. I queried what is the proportionate loss of weight of objects carried to the greatest height attained by balloons, say approximately five miles. Of course, in determining this balances or steelyards could not be used; but spring scales probably could be used so as to determine the loss of weight and the percentage thereof. A. Sir Isaac Newton, who died March 20, 1727, fully investigated the action of gravitation, and determined the law of the weight of bodies at all distances from the center of the earth. It is that the weight decreases at the same rate as the square of the distance from the center of the earth increases. If anything weighs 100 pounds at the level of the sea on the earth, at twice the distance from the center of the earth that body will weigh only one-quarter as much. Taking the surface of the earth as 4,000 miles in round numbers from the center, twice as far would be 8,000 miles; at 8,000 miles from the center of the earth, the weight which was 100 pounds at sea level

will have decreased to 25 pounds. At 5 miles above the surface of the earth, the change of weight will be in the ratio of $4{,}000^2$ to $4{,}005^2$. This decrease is very slight for short distances. As you say, it cannot be detected with a steelyard. A spring balance would give the change of weight if it were delicate enough. A pendulum is, however, the instrument actually employed for the purpose, since its time of swing depends upon the force of gravitation.

(10781) W. H. D. asks: Have you a SUPPLEMENT which fully gives the cubical difference in pipes and their capacity for delivering water under given pressure or fall, say 10 feet to 100 feet to run? I confess the most abject ignorance of a principle, and I know there is one; for instance, the difference in the carrying capacity of a ⅜ and ½ pipe, ⅞ and ¾, etc. I notice my pipe, ⅜ new lead, 35 rods, 67 feet fall, gave me (old-fashioned milk measure) 1 quart in 19 seconds; the decline continuous, but I am not helped out on the point I am after, for the ½-inch lead pipe, same fall, only favors me about 5 seconds. A. We refer you to an article on the flow of water though pipes, in SUPPLEMENT No. 791, price ten cents mailed. The question of determining a quantity of water which will flow under a given head from a long pipe is a very complicated one, because the coefficient of friction is not constant, but varies with the size of the pipe and the velocity of flow. The formula which is usually used to determine the velocity at the further end of the pipe is as follows:

$$h = \frac{v^2}{2g} \times \left(l + 4f \times \frac{l}{d}\right).$$

Where h = the head in feet.
v = the velocity in feet per second.
g = 32.2.
l = the length of the pipe in feet.
d = the diameter of the pipe in feet.
f = the coefficient of friction.

The value of f varies from 0.008 to 0.006 for a 3-inch pipe, as the velocity of flow in the pipe increases from 1/10 of a foot per second to 20 feet per second; while with a half-inch pipe it varies from 0.0150 to 0.006 under the same circumstances. From the above you can roughly estimate the proper coefficient of friction for a given pipe and a given velocity. Substitute this coefficient of friction in the formula given above, and determine the velocity with which the water will issue from your pipe at the further end by solving the equation for v. When the velocity is known, the quantity may be determined by the formula:

$$Q = 0.78d^2v.$$

Where Q = the flow of water in cubic feet per second, and d = the diameter of the pipe in feet.

(10782) M. H. H. says: Will you please inform me through your "Notes and Queries" column, whether or not glass can be sensitized so as to print upon it from a negative, and how to sensitize it? A. A glass photographic plate may be used for making a positive from a negative just as it is for making the original negative. The sensitive material is a silver salt imbedded in gelatine or collodion. Glass itself cannot be made sensitive so as to have a photograph taken upon it directly.

(10783) M. M. says: Will you kindly answer by letter the address of all the trade schools outside the one at First Avenue, 67th and 68th Streets, New York, which is filled? A day school where plumber's trade is taught. Please answer as soon as possible. A. The New York Trade School is the only trade school that we are certain has a day course in plumbing. We would advise you to write for catalogues, however, to Pratt Institute, Brooklyn, N. Y.; St. George's Evening Trade School, New York; McAlpin Trade School, New York; Baron de Hirsch Trade School, New York city; Highland Falls Trade School, Highland Falls, N. Y.; North End Trade School, Boston, Mass.; Charitable Mechanics' Association Trade School, Boston; Williamson Free School of Mechanical Trades, Williamson, Pa.; California School of Mechanical Arts, San Francisco, Cal.; Wilmerding's School of Industrial Arts, San Francisco, Cal.

(10784) H. J. H. says: In the physics class recently a discussion arose concerning the direction or directions in which the explosive power of dynamite is exerted. The teacher contends that the explosive force is exerted equally in all directions; the students, that the greater part of the force is exerted in a downward direction. Will you please decide which is correct? If force is exerted in a downward direction, why? Students base their contention on the fact that the textbook says: "Dynamite placed and exploded *on* a rock will shatter the rock." A. Replying to your question, we would say that your teacher is right; the force exerted by any explosive is one caused by a large volume of gas suddenly liberated, and a gaseous pressure is always exerted equally in all directions. The opinion which you hold is a very common one, which arises from not fully understanding the nature of an explosion. When a large amount of gunpowder placed on the surface of the earth is exploded, a very large volume of gas is suddenly liberated by the burning of the powder. In this case, however, the liberation of the gas is not instantaneous, and there is sufficient time for the gas to escape upward into the atmosphere before the pressure, which acts equally in all directions, is sufficient to greatly affect the surface on which the gunpowder was set off. If the powder could have been burned ten times as rapidly, the same amount of gas would have been liberated; but because it was liberated more rapidly, the pressure would have been many times greater, and sufficient in all probability to scatter the earth or rock beneath it in all directions. When dynamite is exploded exactly the same effect takes place, excepting that in the case of dynamite, the gas is liberated almost instantaneously. In this case there is not time for the gas to escape upward before such an enormous pressure is exerted in all directions that whatever is near it, either above or below, is shattered.

(10785) J. K. says: 1. I want to make a sounding box 10 inches in diameter and 4 inches high. What material should I use, and of what thickness for top, bottom and sides? A. A sounding box may be made of any kind of wood, excepting the part which gives the resonance. This should be made of clear pine or spruce, very resonant woods. The resonant side may be from an eighth to a quarter of an inch, depending upon the kind of instrument upon which it is put. No general answer can be given. The back and belly of a violin are not usually as thick as an eighth of an inch. 2. What is meant by tensile strength? When the quantity of lumber is expressed in feet, which is meant—square or cubic feet? A. Tensile strength is the force required to pull open a wire or bar or rod of any given material, when the piece has a section of a square inch. When lumber is given in feet, the square foot or superficial foot with a thickness of one inch is understood. Thus a plank two inches thick has twice as many feet in it as a piece one inch thick. 3. Why is it that a locomotive with 1,500 or probably little more horse-power can attain a speed of 80 or 85 miles an hour, with a train of 250 or 300 tons, whereas a racing automobile with 90 horse-power and weighing about 3,500 pounds, which represents a much greater power per pound of weight moved, attains only the same speed as the locomotive does, and in some cases even smaller? A. The statement of the speed of automobiles hardly represents the latest records. However, the locomotive has the momentum of the heavy train to help it. A light weight cannot be given so great a velocity as a heavy one. A very light ball cannot be batted so far nor sent so fast as a heavy ball.

(10786) S. F. B. asks: Please be so kind as to inform me what alteration should be made in the winding of the 8-light dynamo in order to make it suitable for lighting 110-volt 16-candle-power lamps. Also which of the two armature cores is the better, and do you consider this dynamo a practical electric lighting machine, and do you have the plans for a more up-to-date machine for electric lighting of about the same capacity? A. The 8-light dynamo is a practical machine, even now, twenty years since it was designed. Many of them are in operation and doing their work well. We have not published the plans for any other machine of this size. The armature composed of sheet iron disks is much to be preferred to a wire-wound armature core. Some very good alterations have been made in this dynamo by certain parties who have built it. These are described in answers to queries No. 8250 and 8316. These you may have if you have kept the back numbers of the paper. To make a 110-volt shunt-wound machine from the same castings for the armature use No. 22 B. & S. cotton-covered magnet wire, 24 coils of 25 turns each; for the field use No. 23 B. & S. cotton-covered magnet wire, 3,640 turns on each magnet. A resistance box to regulate voltage should have about 200 ohms.

(10787) H. G. R. says: Can you tell me what is generally considered to be the proper degree of humidity for rooms in a dwelling house? The hygrometer in my house varies from 20 to 40, even when I evaporate water on the registers. The house is heated by a hot-air furnace in which is a receptacle for evaporating water, but this does not seem to have much effect. Can you suggest an easy and practical method of getting the right degree of moisture in the air and of maintaining same? A. There is no recognized degree of humidity which is regarded as better than any other. It is usually considered that a very dry atmosphere is more healthful than a damp one, and the opinions of physicians differ regarding the value of increasing humidity in dwelling houses during the winter by the evaporation of water. The only ground on which the practice can be justified is that it may tend to make the variation of humidity in the atmosphere of the dwelling less from day to day than would otherwise be the case.

(10788) C. K. K. asks: I want to silver-plate on wood or other substances. Have you any reasonably-priced book on this subject? Electro-plating, I presume it is termed. A. Electro-plating on wood does not differ from plating on any other material electrically. It is necessary to coat the wood with some material impervious to water, and then cover it with plumbago to render the surface a conductor of electricity. Soaking the wood in hot paraffine may close the pores so that it will not soak water, and the paraffine will take the plumbago very well. The plating process is well described in the book "Modern Electro-plating," by Van Horne, which we can send for $1. Another method for coating a surface and making it a conductor is given quite fully in answer to Query No. 8661, Vol. 87, No. 7.

(10789) J. E. W. asks: Would you please explain through your columns how an incandescent lamp is made, and what materials are used in electric lamps, and how is the vacuum put in the globe? A. The making of an incandescent electric lamp involves a great many processes. The glass bulb is blown, and the several parts which can be seen from the outside are each made by different hands and fastened in their several places, thus forming the lamp as it is finally used. Upon the large end of the bulb is a piece of glass tubing by which the lamp is connected to an air pump, and the air in the bulb is finally pumped out, thus producing the vacuum. The vacuum is not put into the lamp, but the vacuum is made in the lamp by removing all the air. A full description of the making of a lamp may be found in our SUPPLEMENT No. 1377, price ten cents.

(10790) G. W. N. asks: Will you kindly inform me if there is a non-freezing solution for cooling gasoline engines? I have 4½ horsepower with 25 gallon tank. Also what chemical effect, if any, same has on the castings? A. There are three common methods of keeping water in the cooling coils of automobiles from freezing. 1. Use a mixture of four parts water and one part wood alcohol. The difficulty with this method is that the wood alcohol tends to evaporate out from the water and has to be replaced from time to time. 2. Use a nearly saturated solution of calcium carbonate. The difficulty with this solution is that it has a slight tendency to corrode the metal it comes in contact with. 3. Use a mixture of four parts water and one part glycerine, to which should be added about one pound of ordinary washing soda for every ten gallons of the mixture, to correct a slight tendency toward acidity from the glycerine. It is possible to freeze any one of the above mixtures if the temperature is sufficiently lowered, but none of them is likely to freeze at a temperature above about zero Fahr. Any one of the three mixtures will give satisfactory results, but in our judgment perhaps the third is the best. If a mixture is desired for a temperature below zero degree, we would recommend adding wood alcohol to the third mixture. While we have had no experience with this, we believe it would give good results.

(10791) D. L. G. asks: Being a subscriber to your paper, I will ask a few questions. We receive a bundle of paper here every week, and once in a while it becomes electrified, it attracts other paper. How does this become electrified? Where does it get its electricity? Does the turbine wheel resemble a Pelton wheel? Are the turbines they use in boats like the Pelton waterwheel? A. Paper is easily electrified by friction in cold and dry weather, so the paper bundle by being tossed about and rubbing against other things becomes electrified. It does not need to get electricity from anywhere outside of itself. There is electricity in everything, and anything we do to produce electricity, as we call the operation, only causes the *manifestation* of electricity, which was in the thing before we made it manifest itself. We do not call any electricity into existence, we can only make visible the presence of electricity which was not visible before. The steam turbine acts on exactly the same principle as the Pelton waterwheel, the only difference being that the steam turbine has a very large number of small buckets, and the steam which acts on them enters the buckets at an angle instead of at right angles to the axle of the wheel, and at as many different points as there are buckets in the circumference of the turbine. Also with the steam turbine there are a number of rows of buckets mounted on the same shaft, and the steam after leaving one set of buckets passes fixed vanes which alter its direction before it reaches the second row of buckets. In this way the steam turbine is like a compound Pelton wheel having a number of wheels parallel with one another on the same shaft, arranged in such a way that the water passes through one after leaving another.

(10792) G. C. E. asks: Have you any back numbers telling how a telephone transmitter is made, both carbon and induction, and which is counted the best, say for a two-mile line, and why? Same in regard to receiver. Could a battery be used in place of magnets for call, and how many cells with twelve galvanized line wire? Same with copper wire? Is metallic circuit necessary, or can one wire grounded at each end do? I mean for the telephone. Are both receiver and transmitter necessary, or can one be used for both purposes for that distance? Also, I wish to know how to make a microphone, or number of paper describing same. A. We have published in our SUPPLEMENT, No. 966, and in the SCIENTIFIC AMERICAN, Vol. 72, No. 4, full descriptions for the making of a carbon telephone transmitter and induction receiver. The two are not used at present, interchangeably; the receiver can be used as a transmitter, but the action is so poor that no one would think of relying upon it in regular service. A bell rung by a battery can be used for a call, as well as to ring the bell by a magneto. The number of cells will depend upon the manner in which the line is put up. Probably four to six will ring the bell; if not, add more. One would not put up a copper line for so short a distance and not very frequent service. In the country, away from other electric lines, a return wire is not needed; but if the line passes near other electric lines, a metallic circuit is necessary. A microphone is made by arranging two pieces of carbon so that they are loosely in contact. A current of electricity sent through the poor joint is varied by the changing pressure of the pieces of carbon upon each other. A great many forms of this have been devised. SUPPLEMENT No. 163 gives figures and description of several forms. SCIENTIFIC AMERICAN and SUPPLEMENT copies are mailed on receipt of 10 cents each.

NEW BOOKS, ETC.

THE STORY OF IRON AND STEEL. By J. Russell Smith, Ph.D. New York: D. Appleton & Co. 16mo.; cloth; 193 pages, illustrated. Price, 75 cents net.

This handy little volume is an attempt to present the main facts of iron and steel making so that any intelligent person can grasp the conditions of the complex technical phenomena of the industry, without even having to meet technical terms. Every paragraph has been made intelligible to the lay reader, and, in addition to presenting an understanding of the main technical facts, the major object has been to point out the economical significance of iron and steel, and lay the fundamentals of the present industrial state. To combine and condense in a small volume the gist of a subject of the magnitude of the making and, to a certain extent, the use of steel and iron, is a feat worthy of no small praise. The history of the subject alone provides material from which books to fill a library might be written. The author, by judicious selection of matter, gives a very good view of the art without burdening the reader with an overwhelming mass of facts.

HOW TO MAKE AND USE INDUCTION COILS. By Edward Trevert. Revised by B. Edmunds. Lynn, Mass.: Bubier Publishing Company. Illustrated. 16mo.; cloth; 74 pages. Price, 50 cents.

A great deal has been written on induction coils, and a book, to be absolutely novel, must contain features that are startling in their nature. Although this work contains nothing startling, it does contain directions and drawings, together with expositions of principles, and space devoted to batteries, by a thorough assimilation of which any one should be able to make and intelligently operate an induction coil of such spark-producing size as he may see fit to build.

HYDRAULIC ENGINEERING. A Treatise on the Properties, Power, and Resources of Water for All Purposes. By Gardner D. Hiscox. New York: The Norman W. Henley Publishing Company. 8vo.; cloth; 300 illustrations, with 36 practical tables; 315 pages. Price, $4.

The need of a general yet compact treatise on hydraulic engineering, has long been recognized by students and engineers. The writer supplies such a volume, presenting first, a brief technical sketch of the development of hydraulic engineering from the earliest times. A systematic and progressive statement of the mechanics of water and fluids in general follows, including hydrostatics or the equilibrium of fluids, hydrodynamics, which treats of the laws of liquids in motion, and hydraulics, in which the motion of water in pipes and canals is considered. The writer makes every detail perfectly clear, and cites the necessary formulas in their simplest expression, explaining them further by figured examples. The air-lift method of raising water has been allotted an entire chapter for its complete presentation, especial prominence being given the Pohlé Air-Lift, which is fully described, including single and multi-stage applications, with illustrations showing the arrangement of air and water pipes, rules for calculating the volume of air required for raising the water being also included. A number of tables, some thirty-six in all, will be found useful for reference, including the properties of water, coefficients for hydraulic grades, discharge of water from orifices and nozzles, pressure loss by friction in fire hose, velocity, discharge and horse-power of nozzles, and volume of water over weirs, loss of head by friction of water in pipes, etc.

PROFIT MAKING IN SHOP AND FACTORY MANAGEMENT. By Charles N. Carpenter. New York: The Engineering Magazine. 12mo.; cloth; 146 pages. Price, $2.

"Profit Making in Shop and Factory Management" is a concise expression of the methods which Mr. Carpenter has developed and which he constantly uses in his own practice. The head of a great manufacturing plant, the Herring-Hall-Marvin Safe Company, he has arrived at his position through various steps, holding, in the course of his promotion, the position of supervisor, manager, and head of the labor department of the National Cash Register Company. The material from which the book has been compiled appeared first in the Engineering Magazine during the year 1907 in the form of a series of articles. As they are now presented, they have been carefully revised, enlarged, and, to a certain point, rearranged.

The division of chapters has also been introduced. All alterations are only in details, more effectively adapting to permanent form the sections which previously were produced serially. The methods will be found to be marked throughout by the clear sight, the fair mind in dealing, and the strong vitality of the author.

DECORATION OF METAL, WOOD, GLASS, ETC. A Book for Manufacturers, Mechanics, Painters, Decorators, and all Workmen in the Fancy Trades. Edited by H. C. Standage. New York: John Wiley & Sons. 12mo.; cloth; 228 pages. Price, $2.

Although, quite naturally, we have not tried all or in fact any of the recipes contained in this volume, upon reading them over each one seems to be drawn up in a manner to give the best results for the purpose for which the particular recipe is desired. The various methods of browning iron and steel, such as gun barrels, and of gilding upon metal or silvering glass are all useful, and it seems, for the practical man, that this work should demonstrate its serviceability in a very short period of use.

LECTURES ON SCIENCE, PHILOSOPHY, AND ART. A series of twenty-two lectures in untechnical language indicating the present status of science, philosophy, and art, as concepts of human knowledge, delivered at Columbia University during the academic year 1907-08, by various professors chosen to represent the several departments of instruction. New York: Columbia University Press. Price of each lecture, 25 cents.

The lectures in this series which naturally interest us most are those delivered by Prof. C. J. Keyser on Mathematics; Prof. Ernest Fox Nichols on Physics; Prof. Charles F. Chandler on Chemistry; Prof. Harold Jacoby on Astronomy; Prof. James Furman Kemp on Geology; Prof. Edmund B. Wilson on Biology; Prof. Frederic S. Lee on Physiology; Prof. Herbert Maule Richards on Botany; Prof. Henry E. Crampton on Zoology; Prof. Franz Boas on Anthropology; Prof. James Rignall Wheeler on Archæology; and Prof. Robert S. Woodworth on Psychology. Every subject is treated much in the same way. That is, each starts with the currently accepted definition of the science of which it treats; then passes to a short historical review of the science's development, and finally presents a concise statement of its present status and its possible future development. As a whole the lectures give one a swift glance of the present status of modern science.

SECONDARY STRESSES IN BRIDGE TRUSSES. By C. R. Grimm. New York: John Wiley & Sons. 8vo.; cloth; 140 pages, illustrated. Price, $2.50.

A comprehensive treatise on secondary stresses with numerous numerical examples involves an extraordinary amount of time and labor in its preparation, so the writer confined himself to a narrower field. It is owing to these circumstances that the most important secondary stresses, namely, those which are due to riveted joints in trusses, are discussed principally. In substance four principal methods of calculation of secondary stresses, which the reader may study separately and apply, are given. The principle of least work leads also to the desired results, but it is far removed from shortening the labor. The nature of the subject forbids a very quick determination of the stresses, and definite rules or formulas cannot be given. The problem of secondary stresses has been put in the proper light and the theories worked out entirely by German authors, who have furnished also the greatest and best part of the contributions to the literature of this subject.

STATIONARY ENGINEERING. A Reference and Text-Book Written Expressly for Stationary Engineers and Firemen, Also Mechanical Engineers, Consulting Engineers, Electrical Engineers, Universities, and Schools. By Joseph G. Branch. Chicago: Rand, McNally & Co. Three volumes, 1057 pages; 325 illustrations; cloth bound. Price, $7.

Not long ago we reviewed the first edition of this work, giving a brief statement of its merits. As we have not the first edition at hand we can make no accurate comparison of the two, so all that we have to say is based upon the three volumes that are now before us. In completeness, in thoroughness, and in clearness of treatment this work is unexcelled. There can be no requirement of the practical man along the lines to which it is devoted that it does not cover, and we feel that we can recommend it to anyone desiring a good treatise on stationary engineering.

THE TRANSMISSION OF MILITARY INFORMATION. By Lieut.-Col. George P. Scriven, U. S. A. Governors Island, 1908. 8vo.; pp. 153.

These papers, which were originally prepared for the Journal of the Military Service Institution and republished by order of the Chief Signal Officer of the Army, present a survey of the field opened by modern science to that corps of the army which is intrusted with what are technically known as Lines of Information. As far as the numbers and completeness of the organization, both of signal troops and armies in the field, and of all future systems of coast defense are concerned, the conclusions arrived at in these papers are based more upon the ideal than the probable conditions. They outline the whole from which a necessary part, agreeable to existing conditions, may be subtracted. No branch of the military art offers a wider field for development than that of the Service of Intelligence; and this work is submitted to signal officers and all others interested in the subject, in the hope that they may materially assist in this development. The work is in four parts. Part I deals in general with the importance of the transmission of military information; Part II treats of the Signal Corps and the Mobile Army, duties, lines of information, organization, and the use of wireless telegraphy; Part III is a continuation of Part II, dealing similarly with the Signal Corps and the Mobile Army, but under the head of electrical and visual communications; Part IV is devoted to the Signal Corps and the Coast Defense, and deals with the coast patrol and the relation of the Signal Corps to the Coast Artillery. This work will be found to be an important and very practical contribution to the literature of the subject on which it treats.

TOLHAUSEN'S TECHNOLOGICAL DICTIONARY IN ENGLISH, GERMAN, AND FRENCH. Containing All of the Technical Terms Used in Industries, Crafts, Arts, and Sciences. Fifth edition. Three volumes. Red cloth binding. New York: The Macmillan Company. Size of single volume, 6⅞ x 5½ x 2¼ inches. Vol. I. French-German-English. Vol. II. English-German-French. Vol. III. German-English-French. Price, $2.75 net per volume.

This valuable work by Alexander Tolhausen, Ph.D., translator to the Great Seal Patent Office of Great Britain, first published in 1877, is now issued in a fifth edition revised and brought down to date by Louis Tolhausen, former consul-general of France to Great Britain. The new industrial era inaugurated during the 19th century, especially among the nations using the English, German, and French tongues, created an ever-spreading technological literature in these languages, to which the need of a dictionary-guide and a memory-aiding manual soon became apparent, and for the preparation of this, the high attainments of the author especially fitted him. The chief aim of the author in his long labors and patient research was to unite in the smallest space, and at the most moderate price possible, the greatest number of technical terms used in the three languages, belonging to the subjects enumerated in a given classified list of industries and crafts. In this he succeeded admirably. Each volume contains over 75,000 such terms with their equivalents in three languages and includes a valuable bibliography of the principal works consulted in its compilation, a classified list of the industries and crafts dealt with, and a large supplement containing all modern terms and expressions used in electricity, telegraphy and telephony. The value of such a work to all scientific institutions, trade schools, industrial laboratories and establishments, cannot be too highly estimated, while it should find a prominent place on the reference shelves of every library throughout the country.

A SCRAP-BOOK OF ELEMENTARY MATHEMATICS, NOTES, RECREATIONS, ESSAYS. By William F. White, Ph.D. Chicago: The Open Court Publishing Company, 1908. 12mo.; cloth; 128 pages. Price, $1.

Pure Arithmetic, that is, arithmetic for its own sake, is full of interest and charm. It provides the mind with recreation which strengthens and sharpens its powers at the same time that it furnishes rest and amusement. Although by no means deep or continuous, the Scrap Book contains short statements of fact and of interest, making it a readable and suggestive work.

LE PEROU D'AUJOURD'HUI ET LE PEROU DE DEMAIN. Par Em. Guarini. Paris: H. Dunod et E. Pinat, 1908. 8-16 pp.

LES MEILLEURES RECETTES PRATIQUES. Recettes des Arts et Métiers. Paris: B. Tignol. 16mo.; 176 pages. Price, 2 francs.

NEPHILIM. By William J. H. Bohannon. New York: Reeve A. Silk. 12mo.; cloth; 236 pages. Price, $1.50.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending May 19, 1908.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abrasive material, manufacture of, F. J. Tone ... 888,129
Addressing machine, B. S. Molyneux ... 888,342
Advertising and other air ship, J. C. Burnell 888,220
Advertising device, W. D. Butt ... 887,766
Aerial apparatus, C. J. A. Fiesse ... 887,931
Air shield, J. H. Koons ... 888,097
Air ship, J. C. Sandrik ... 888,267
Air ship, G. Bold ... 888,301
Alcoholic liquid, rectifying of, E. Guillaume 887,793
Aluminium nitrids, producing, O. Serpek ... 888,044
Amusement apparatus, J. Henzi ... 887,803
Amusement device, F. Johnson ... 887,812
Amusement device, J. De la Mar ... 888,246
Animal trap, W. Z. Pierce ... 887,843
Arsenoarylglycin, Ehrlich & Bertheim ... 888,321
Automobile gearing, L. V. Lochner ... 887,824
Auxiliary heater, W. C. Richman ... 888,035
Awning operator, electric, E. U. Giovannoni ... 888,157
Axle, cast iron, E. R. Robinson ... 887,848
Axle lubricating device, M. H. Elliott ... 888,322
Balancer set, R. W. Douglass ... 888,392
Bale tie, cotton, W. C. Ragsdale ... 888,351
Ball and socket joint for pipe connections, J. H. Windemuller ... 888,288
Barometer, B. Junquera ... 888,015
Barrel, collapsible, D. B. Jones ... 888,334
Barrel cover, D. U. McKeen ... 888,029
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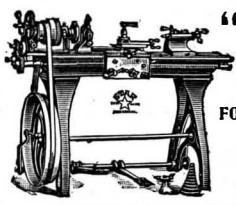

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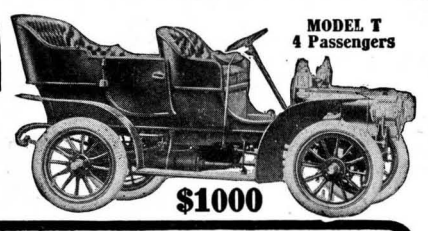

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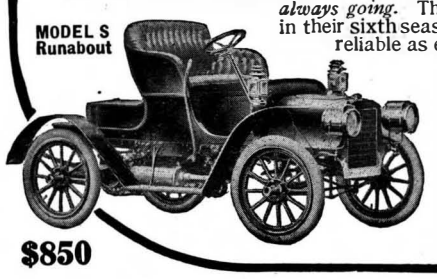

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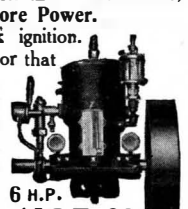

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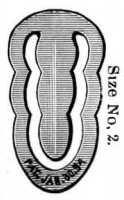

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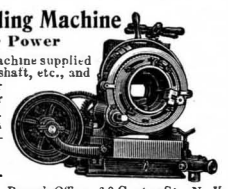

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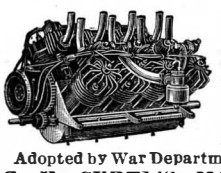

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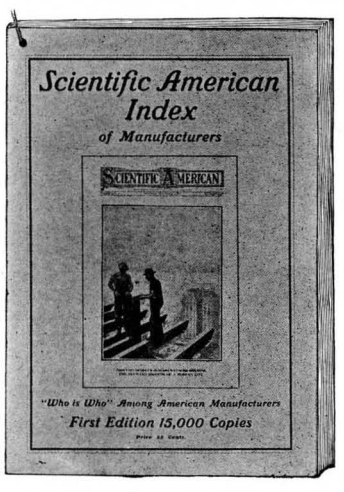

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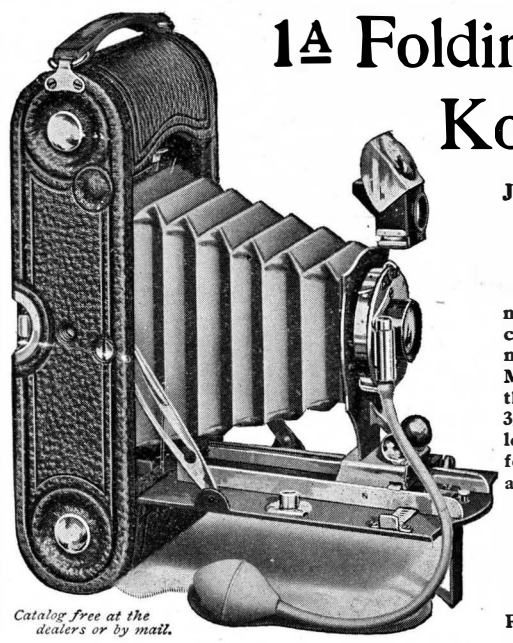

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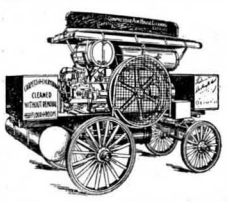

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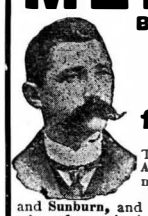

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Inquiry No. 8646.—Wanted to buy cheap small motor from ¾ to 1 horse power, single phase 60 cycle, 110 volts.

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Inquiry No. 8651.—Wanted to buy apparatus for making gas from oil.

Inquiry No. 8652.—Wanted address of manufacturers of drop forged wrenches.

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Inquiry No. 8662.—Wanted to buy small machine for drawing thread from cotton and machine for making lozenges.

Inquiry No. 8663.—Wanted to buy file cutting machines.

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Inquiry No. 8704.—Wanted address of kaolin expert.

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Valve mechanism for air compressors, T. H. Smith	888,126
Valve, slide, J. Hargreaves	887,798
Valves, bush for, Flegehen & Hart	888,782
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Beverages, carbonated, D. Bernhard & Co.	69,058
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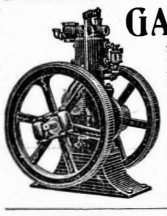

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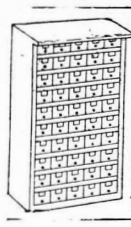

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Chocolates, Imperial Chocolates Co.	69,040, 69,041
Cigars, A. Rosendahl	69,096
Clothing, certain, Conhaim & Co.	69,085
Coffee, Meyer Brothers Coffee and Spice Co.	69,047, 69,050
Coffee, C. H. Conrad	69,060
Colloidal silver, Heyden Chemical Works	69,134
Corsets, H. H. Treffer	69,089
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Cotton ducks, drillings, and sheetings, J. Spencer Turner Co.	69,153
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Evaporators, fruit and vegetable, B. L. Ryder Co.	69,057
Feed, stock, North-West Mills Co.	69,101
Fertilizers, Virginia-Carolina Chemical Co.	69,051
Flavoring extracts, food, E. M. Chase Co.	69,106
Flour, wheat, Bowersock Mills & Power Co.	69,083
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Foods, certain, Crocker Grocery Co.	69,104
Foods, certain, George Liss & Co.	69,107
Gas burners, mantels for incandescent, Ramie Co.	69,112
Gas generators and lamps and parts thereof, acetylene, E. M. Rosenbluth	69,113
Glue and glue pitch, marine, Jeffery's Patent Marine Glue Works	69,042
Hair tonics, Southern Medicine Co.	69,139
Hams and bacon, Street and Corkran Co.	69,069
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Shoes, leather, Krippendorf-O'Neal Co.	69,155
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Soap, Swift & Co.	69,140
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"Damiana," for a cordial, Mezcal Tequila Distillery Co.	14,199
"Dr. Bizmatt's Celery Tonic," for a medicinal tonic, G. Sapiro	14,206
"Flor-Fina," for cigars, G. Dottling	14,196
J. Clavel Company Vermouth," for vermouth, J. Clavel Wine & Cordial Co.	14,204
"Leon De Lis," for cigars, American Lithographic Company	14,198
"Magic Twins Inky Racers," for liquid ink erasure, Dr. Wm. R. Wales	14,208
"McFadden's Dan-Do," for a hair tonic, R. M. McFadden	14,207
"Mezcal Tequilla," for a liquor, Mezcal Tequila Distillery Co.	14,200
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"Silver Star," for herring roe, E. C. Geyer	14,203
"Sonomor," for placket fasteners, William Prym, Gesellschaft mit beschrankter Haftung	14,211
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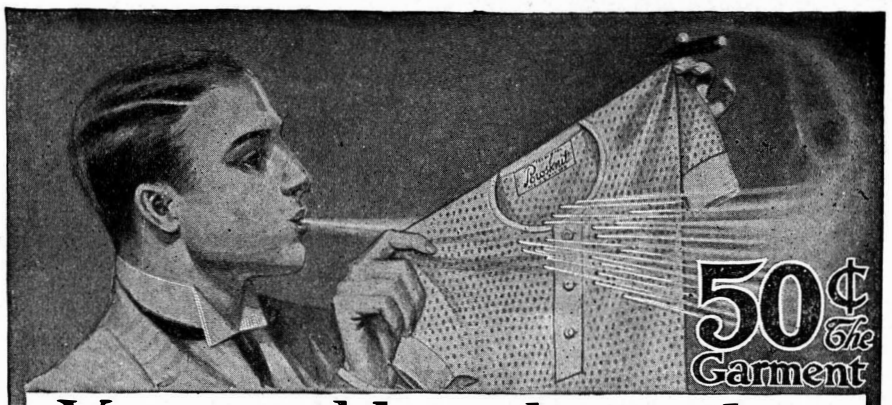

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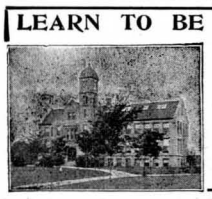

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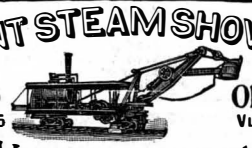

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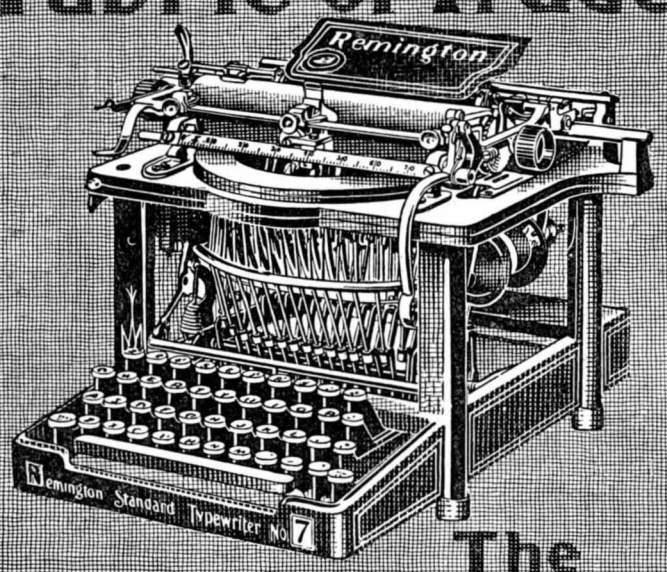

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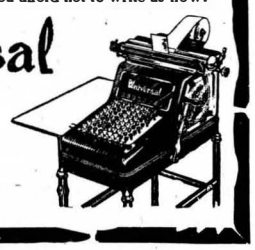

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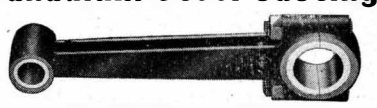

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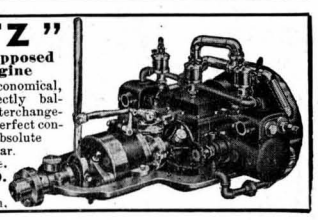

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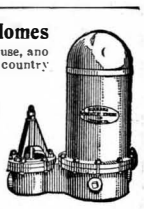

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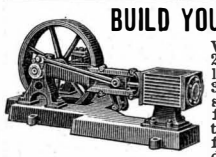

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